RAILROAD GAZETTE

FRIDAY, FEB. 13.

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Contributions.

Express Trains in England.

PARIS, Jan. 28, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

An instance of the extreme frequency of high-speed trains in England is seen on the Great Northern Railway, where there are, at this moment, two express trains which leave the same town within nine minutes of each other and run over the same course of 105¼ miles without a stop, in very nearly the same time. One train makes the run in 117 minutes, or at 54 miles an hour; the other in 123 minutes, or at 51 miles an hour. In doing this they pass through an important city, populous towns and manufacturing districts; and over a road not so well suited to fast speeds as many other English lines. This one, however, never takes second place either for speed or long distance runs in the regular daily service.

There were illustrated in the *Railroad Gazette* of May 9, 1890, on page 317, two types of engines (Nos. 1 and 3) that perform this work; unless it is, also, by an inside-cylinder engine, with smaller coupled wheels, 6 ft. 7½ in. diameter, but of the same build as the one shown with single leading wheels. Standing on a country bridge, ten miles from London, where these trains frequently pass at over 70 miles per hour, we have noted the big-wheel engine appears to make very easy work, and has a slow, lurching movement, although its boiler is not very high centered; but the engine of the following train, which passes with its coupling-rods turning at almost vanishing speed, appears to have much less side-roll, and that may be due to a more even distribution of the weights on the rails than with the famous 8-ft. driver engines.

K.

The Price of Safety.

LONDON, Jan. 23, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

One word in answer to your editorial, whose fairness I fully acknowledge, and also to your correspondent Archimedes S. Watt, who unconsciously misrepresents what I said in your issue of Dec. 26. Possibly my letter may have been sent to the wrong address. It may be—it would be absurd for a stranger who has only traveled a few thousand miles over the best equipped lines in the country to express any opinion—that in America there is no need to fear that safety appliances will be overdone; that too elaborate precautions will be taken. That some appliances and some precautions are required is of course undeniable; theoretically, every one will admit, in the case of certain others, that the additional safety is not worth the extra price. Practically, in England at the present time the tendency is to look only at the safety gained, and to ignore the price paid; to build, for example, a bridge to carry over the railway a lane with a traffic of three carts a fortnight; to interlock, and furnish with rising-bars and safety bolts and signals and signal lamps, a crossover road which may possibly be used about once in a twelvemonth. In short, to my mind an excellent principle is being ridden to death.

From expressions of public opinion in American newspapers I gathered that there, as here, the public thought they could eat their cake of safety and have their cake of cheapness simultaneously. If I am wrong and the American public is prepared (as I have no doubt the editor of the *Railroad Gazette* is ready), in the case of each proposed new expenditure on preventing the possibility of accident, to ask and answer calmly and deliberately the question, "Is the elimination of the chance of x deaths worth purchasing at the price of y dollars, to come in the long run out of the passenger's and shipper's pockets?" then, sir, my letter ought never to have been written, or at least ought not to have been addressed to an American journal.

W. M. ACWORTH.

Best Method of Supporting Trestle Stringers.

The Pennsylvania Railroad Company,
PHILADELPHIA, Feb. 2, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have noticed in various issues of the *Railroad Gazette* the last year, and also this year, illustrated articles on the subject of standard trestles. In this connection I would remark that from my experience a trestle is very much better to have the four legs of the bent, or the piling, brought near together at the top in order to be nearly under the stringer supporting the rail. The load being over this point, if there is any settlement (and there generally is, even in structures as substantial as well-built masonry), the most settlement will take place at the two centre bearing timbers; and when they go down, the outside legs remain when placed perpendicular intact, strain the cap, and have a tendency to damage or break it at points *A* and *B*, fig. 1.

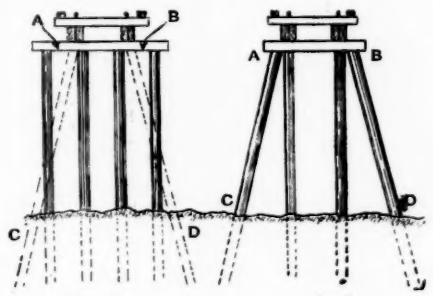


Fig. 1. Fig. 2.

Perpendicular and Inclined Trestle Legs.

I have known an entire pile trestle to be wrecked in this way, and I would recommend constructing with the outside piling on a slope (*A C B D*, Fig. 2). This prevents this trouble, gives better bracing, and more evenly distributes the weight over the base.

J. T. RICHARDS.

Elliptical and Helical Springs.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following problem in regard to the bolster springs for passenger cars has come up for a solution on our road. We have two kinds of springs, as follows:

First—Elliptical, 14½ in. high, unloaded; 10 in. high, loaded; 5¼ in. high, with bands together; carrying capacity, 9,295 lbs.; weight, each, 414 lbs.; cost, $28.98 each, or $115.92 per car.

Second—Helical springs, 14 in. high, unloaded; 10 in. high, loaded; 6 in. high when closed together; carrying capacity, 9,400 lbs.; weight, 122 lbs.; cost, $3.66 each; cost per car, $14.64.

Here is a difference in cost of over $100 per car, an amount which would pay for a large amount of alteration or repairs, and is much in favor of the use of helical springs under passenger cars. I should be very glad if you or any of your subscribers would throw some light on the relative economies of these two springs, as it is a very important matter as I look at it.

The principal likelihood of failure of a helical spring would seem to be that the motion which the springs would be subjected to in a swing truck would be detrimental to the durability of the spring. Again, is there any difference in the quality of the motions of the springs? By loading the helical spring the same as the elliptic, approximately the same deflection from 1,000 lbs. of load is obtained, so that in case the car should pass over a low joint the same deflection would be obtained. As the car would follow the well-known laws of falling bodies, the amplitude and time of vibration would be the same.

It would be possible to connect the bolster and spring plank of the truck in some way to overcome the injurious effects of side motion. Helical springs have taken the place of elliptical in trucks of a great many locomotives, and it would seem that they could be used as driving springs for locomotives and also for passenger trucks.

L. S. RANDOLPH.

How Recklessness is Promoted Among Trainmen.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There is a subject of growing importance to every officer who deals with men by the thousands, which deserves attention, and that is what may be called the secondary effect of the "labor movements" now universal on the large roads in this country.

The general condition of the railroad men's brotherhoods shows either complete inaction on the part of the well-paid officers, so far as any definite improving effect on the attitude of the men toward their employers is concerned, or else an activity that does as much harm as good. The first and principal conception of his duties that a brotherhood "Chief" has, is that he is to be an advocate; and the guiding principle of an advocate, that of sustaining his client right or wrong, has full sway. In every negotiation over the case of a brother whom the railroad company has suspended or discharged, the ruling motive is to get all the advantage possible. This is natural, and I am not complaining because such an attitude results directly in any harm to my road or to any other; but still there is a failure to get the best ultimate benefit from the time, effort, and money expended, which is deplorable. The cheap lawyer, who is an advocate and nothing more, aims simply to work on the prejudices of a dozen ignorant jurymen, and he is, perhaps, not to be greatly blamed for doing so; but a brotherhood leader, whose constituents need instruction as well as defense at his hands, should have a higher ideal. He has to negotiate with intelligent railroad officers who are capable of some degree of justice toward their employés even without the intervention of a third party, and he should, therefore, claim only such points as he knows to be thoroughly defensible. Railroad managers are not overawed by claptrap.

The oldest and best known of the brotherhoods has "Sobriety" inscribed on the topmost folds of its banner, and in the public utterances of its spokesmen that virtue is extolled with all due enthusiasm; but when it comes to the actual case of a brother discharged for drunkenness, what do we see? The local leaders forget their duty to purify the ranks of their order and to carry out their profession of loyalty to the interests of the railroad company, their professed zeal for a high standard of service and for the safety of passenger travel, and work for the reinstatement of their unworthy brother as strenuously as a mother would plead for the life of an only son convicted of a capital crime. Over and over again do we see these exhibitions of self-interest run mad. Other difficulties exhibit traits of character which, if possible, are even worse. The behavior just cited may perhaps be regarded as simply over-warm friendship, and thus often be partially excused; and by tender-hearted superintendents it often is thus excused, to the detriment, I am compelled to say, of the service generally. But when it comes to responsibility for a collision or some other accident, not only friendship but less worthy motives come into play. It is hard enough to cope with the natural unwillingness of one man to report the misdoings of another, which has been a potent fact in all railroad service since long before brotherhoods existed. But now we have this trait combined and intensified. A committee of five will increase the difficulty of getting at the facts of a train accident in proportion to the square of the numbers; that is, they will mix up the reports 25 times worse than one man could do it. Acting on the "fraternal" theory, these men lose sight of all principles of justice and, spurred on by the natural enthusiasm incident to a new-found power, they put their schemes together, till friendliness becomes apology for known wrong-doing, the apology is quickly changed to a bold defense, and the spirit thus engendered becomes the ruling idea of the whole body of men.

The feeling that it is honest to defend a brother whether he be right or wrong has its corollary in the growing sentiment that at all punishment is unjust, and this blossoms into the notion that the Company is always wrong. After a few successful evasions of just discipline the duty of doing one's best in his line of work appeals less forcibly to a brakeman's or an engineer's mind, especially if he be one who does well from fear of punishment rather than from a high sense of duty, and there is a general letting down of vigilance. This is the secondary result of brotherhoods that I have spoken of. I speak but the sober truth, and the experience of more than one general manager, when I say that the feeling that carelessness will not receive its due censure or punishment, is to-day actually encouraging heedless men to be more heedless, and beer drinkers to be worse beer drinkers; and men of this class not only drop to a lower level, but surely drag others down with them. Not only in practice but in precept do they exhibit the results of their illicit education; and new or young men in the service, who would under normal conditions be admonished and taught in the right direction, are trained to be as bad as their fellows. It has been said that thievish conductors will compel new conductors to steal in order to prevent exposure of the old rascals. Whether this be so or not, there can be no doubt that the principle applies in this less heinous class of crime. A trainman whose chief aim is to make time, regardless of rules, when he is drawing pay by the trip; and to kill time, regardless of rules, when he is working by the hour; one who, in short, aims to shirk work regardless of economy or honesty, most naturally endeavors to spread that spirit throughout the force in which he works.

Less heinous crimes, did I say? Here is the most deplorable fact of all. These loose and destructive habits of which I am speaking are indulged in month after month with apparently no thought of the terrible consequences that may result. Putting aside for the time being the mere questions of loyalty to an employer or faithful fulfillment of a contract, the interests of mere money, or the successful operation of a railroad, on which depends the prosperity of the employés themselves, why will not men have a higher regard for their own and their associates' lives and limbs? Generally, indeed, a case of negligence results in nothing worse than destruction of property; but these blunders inevitably tend to increase the more serious class of mistakes, those which result in bad collisions, and men of ordinary intelligence ought to be able to see it. How are we to infuse a new supply of intelligence and honor into these men?

GENERAL MANAGER.

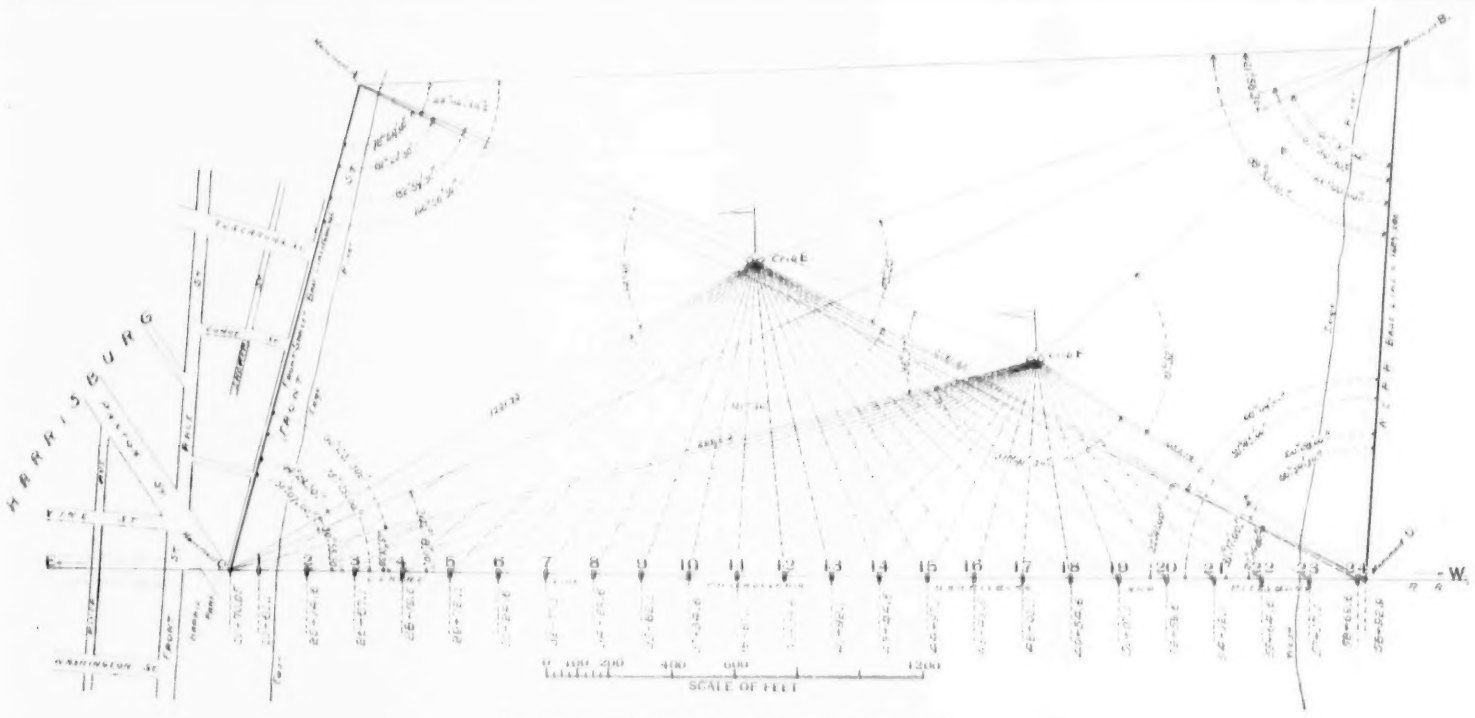
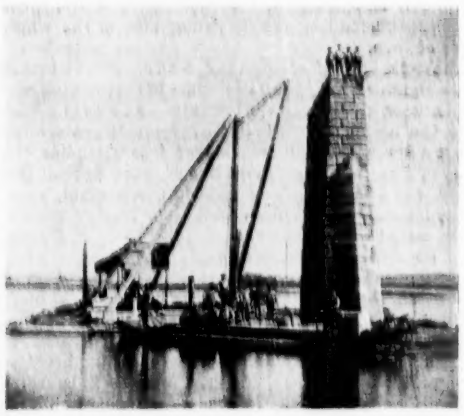


Fig. 1. Triangulation for the Susquehanna River Bridge.

The New Susquehanna River Bridge at Harrisburg, Pa.

BY E. CHAMBERLAIN, ASSISTANT ENGINEER.

The Philadelphia, Harrisburg & Pittsburgh Railroad, upon the line of which this bridge is being built, connects the Lebanon Valley branch of the Philadelphia & Reading Railroad at Harrisburg with the Western Maryland Railroad at Shippensburg, Pa. The final location was completed in the early part of March, 1880, and the contracts for the land work through the city of Harrisburg and the river work were let to the Messrs. Nolan & Brothers, of Reading, Pa., about the same time, who started the former about March 11 and the latter work on April 2.



Channel Pier No. 17.

The land work, which comprised the elevated approach through the city to the river bridge, was built for double track, and consisted of about 500 ft. of embankment a 64 ft. deck, plate girder bridge spanning the Pennsylvania Canal, an 82 ft. through, plate girder bridge spanning the Pennsylvania Railroad (new alignment), 355 ft. temporary wooden trestle work, averaging 28 ft. in height; a 100 ft. through truss and 45 ft. deck, plate spanning the Pennsylvania Railroad and property, an 80 ft. deck, plate girder bridge spanning Second street, and 737 ft. of iron viaduct composed of 15 spans of 30 ft., 3 of 26.70 ft., 3 of 30 ft. and one of 50 ft.

The river work consisted of 23 deck spans, 140 ft. 4 in. from c. to c. of end pins and 24 ft. 9 in. from c. to c. of upper and lower chords (see fig. 3); also one 60 ft. through plate girder bridge spanning the Northern Central Railway. As it was decided to only construct single track superstructure with double track masonry for the river crossing, the bridge was designed so as to add a third truss when the double track would be required. The double track superstructure will be 19 ft. 6 in. c. to c. of trusses, or 9 ft. 9 in. for the single track, as is now being built.

Messrs. Cofrode & Saylor, of Philadelphia, have the contracts for all the ironwork, who, at time of writing [Dec. 19, 1890], have all the ironwork for the approach and 17 of the 24 river spans in place.

The total quantity of masonry in the land work or river approach was 6,258 cu. yds., and in the river piers 9,773 cu. yds., and was completed in five months and 11 days from time of starting. The total quantity of iron work in the approach was 1,942,000 lbs., and in the river bridge 5,551,000 lbs.

The time allotted for construction of the river piers being rather short, it was decided by the contractors to begin work from either side toward the centre, and from the centre toward either side, necessitating a very careful triangulation and base line measurements; also making it necessary to locate the piers by a system of triangulation instead of by a direct measurement. The preliminary base line measurements and triangulations for the length of river crossing were made during the month of August, 1889, and the distance between monuments C and D (see fig. 1) was found to be 3,622.6 ft. In this triangulation two base lines were laid off; one of 1,000 ft. on the east side of the river, along the curb line of Front street, and one of 913.6 ft. on the west side, along the tracks of the Northern Central Railway, measurements being made with a 100 ft. steel tape.

Greater accuracy being required, a final triangulation was made during the month of March, 1890. A 200 ft. steel tape was used for measuring the base lines and the utmost care used to obtain the best results possible. The ground over which portions of the base lines ran was somewhat irregular, making it necessary to elevate one end of the chain at times to bring both ends on about the same level, thereby causing a sag in the chain. In order to account for this sag 200 ft. were very carefully laid out on a level surface with a standard and it was found that by using a pull of 20 lbs. on the 200 ft. tape and elevating one end, as was necessary in making the measurements over the base lines, it corresponded exactly with the standard as laid out on the level surface. We, therefore, adopted a 20 lb. pull in making our measurements.

All measurements were made on damp days, so as to have the least possible variation in temperature. The Front street base line, as laid out in August, 1889, was found to measure 1,000.06 instead of 1,000 ft. The Northern Central Railway base line was extended beyond the August, 1889, measurement and was found to measure 1,689.337 ft. Adopting the Front street line as correct, as the ground was better adapted for the work, hence less liability of making an error, and calculating what the Northern Central Railway line should measure, it was found to be 1,689.288 ft., or .049 ft. shorter than by actual measurement, which was practically nothing. We, therefore, adopted the Front street base as correct and established the distance between monuments C and D as 3,622.85 ft., or .25 longer than the result obtained from the Angus', 1889, triangulation. The repeating method was used in the measurement of the angles and found to give excellent results.

For locating the piers two cribs were sunk in the river below the work and a system of triangulation made to them, as shown in the sketch. These served as transit stations, and also gave an additional check on our centre line calculation. No variation was found.

The first coffer dam was set for pier No. 4 May 2, 1890, in about 4 ft. of water. Piers No. 2 and 3 were left until after rafting season closed. The old style puddle wall dam was used, and owing to the character of the river bottom a great deal of trouble was experienced in keeping the water pumped out. It was therefore decided to use a crib dam, weighted with stone ballast, and the sheet piling and puddling used on the outside, as shown in fig. 2, which gave entire satisfaction. The greatest depth of water encountered was from pier 16 to pier 20, inclusive, where at times we had about 7 ft. With but one exception, it was not necessary to use more than one 6 in. pulsometer pump to keep the dams pumped out. Bed rock was reached in every foundation through bars of gravel and sand, ranging in depth from 6 in. to 4 ft.

The piers were built in range work from bed rock to top coping and of Clearfield County sandstone. Pier No. 1 was 30.7 ft. and pier No. 23 54.5 ft. from top to low water mark, gradient on bridge being about 37 ft. per mile. The elevation of the tops of the cutwaters was about the height of high water in June, 1889, the greatest height known up to that time, which was 26 ft. above low water.

With the exception of piers 1, 23 and 24, derrick boats

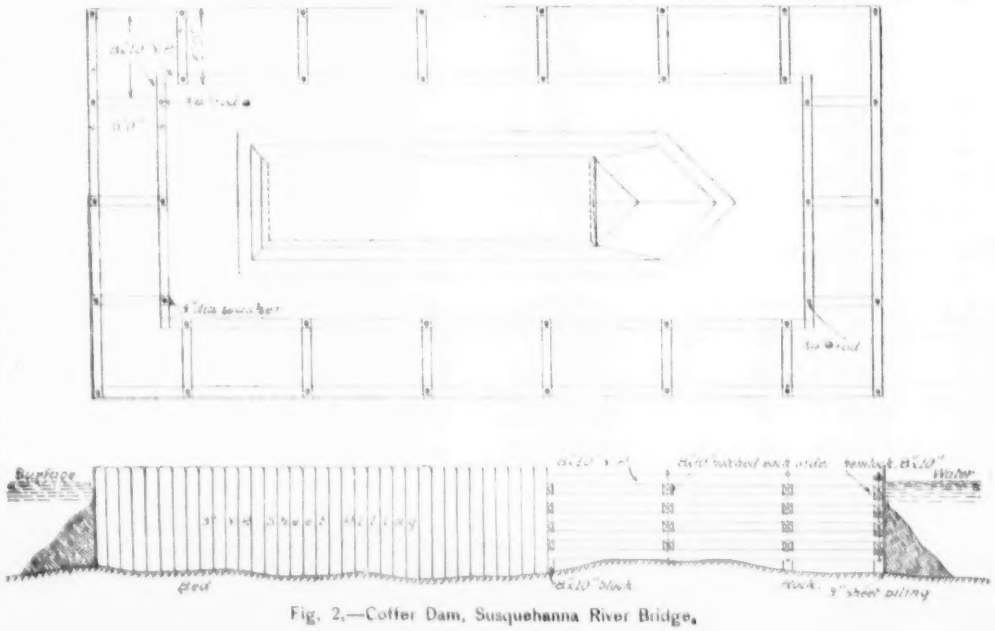


Fig. 2.—Coffer Dam, Susquehanna River Bridge.

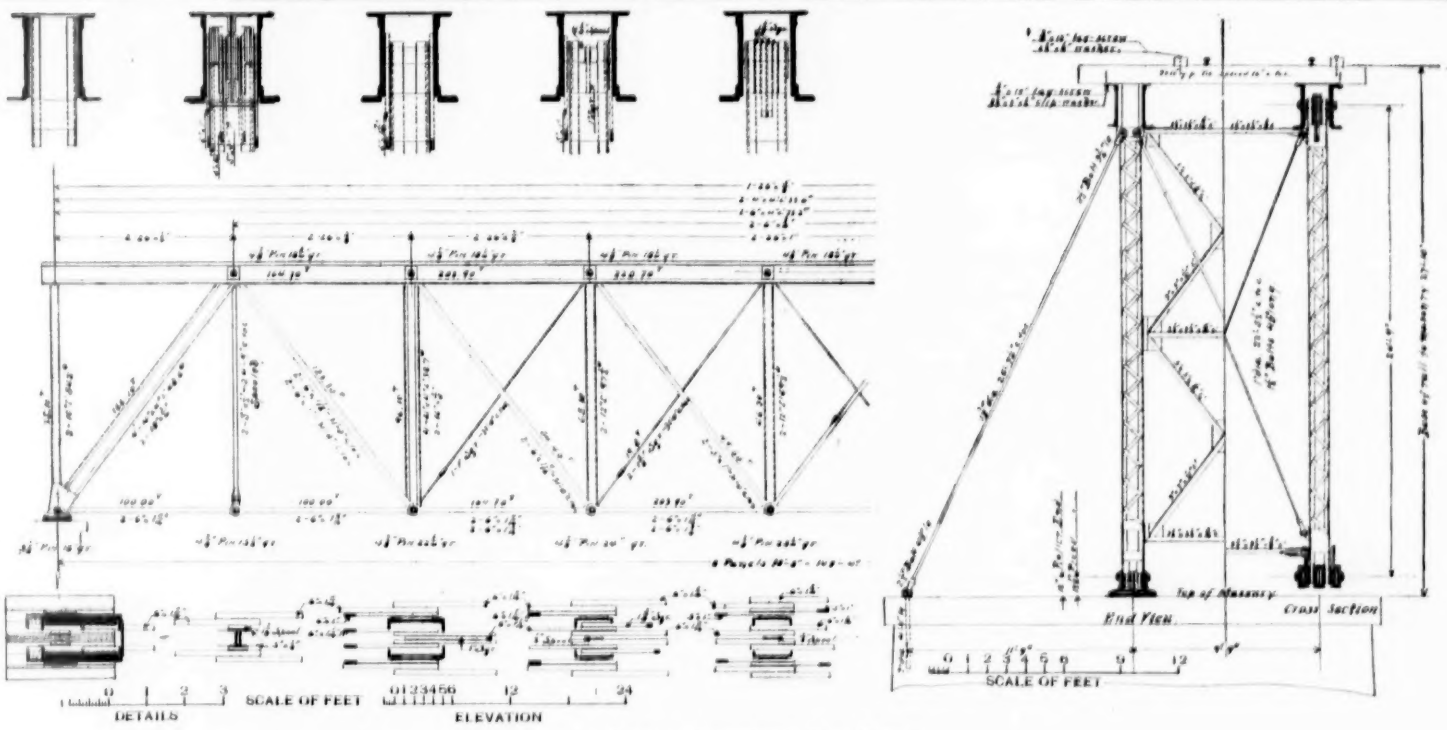


Fig. 3.—Details of Susquehanna River Bridge.

were used in the construction, which were anchored by three 12 in. × 12 in. spuds.

Materials were transported to the work from the east bank of the river by means of flats and steamboats, and from the west bank by a gravity railroad extending from a point about 25 ft. above the surface of water to pier No. 19. The steamboats were found to be the better method of transportation, both in the way of economy and rapidity with which materials could be furnished on the work.

The C., B. & Q. Shops at Aurora.

Two facts are impressed upon one in a visit to the Aurora shops. One is the evident efficiency with which shops can be run without the best equipment, and the other is the conscientious thoroughness with which the material of the road is tested. These shops are not equipped with the most modern tools or the most recent appliances, yet all are in excellent condition, and are so well arranged and operated that a high efficiency is obtained. Probably one reason is the considerable number of special devices and appliances, many of which were designed and built at the shops, that reduce the cost of production of the different parts of the locomotives and cars.

There has been established a flue-cleaning department, which is operated by three men. These three men, with the aid of special tools, have cleaned, scarfed and welded 200 flues in seven and a half hours, and we do not know of another plant in the world in which flues can be handled so rapidly. A large part of the cost of renewing and repairing locomotive boiler flues lies in the cleaning. At the Aurora shops the cost of this work has been greatly reduced by the excellent arrangement of the tools.

There are at these shops a number of quite inexpensive air hoists located at such points as will facilitate the work by furnishing a means of lifting and transporting cylinders and heavy castings with the least labor. The Sellers universal tool grinder is used in the most economical way. It is placed at a convenient point, and the man in charge keeps up and grinds all the tools in the machine shop, thus saving much time to the operators of machines and preventing improper grinding, and thereby loss of tools, and efficiency of machines in which the tools are used. One of the most fertile sources of losses in a machine shop is the use of improperly ground tools.

That the cold saw can do much of the work of planers and slotters is here well illustrated. The work done by this tool at an extremely low cost replaces what would otherwise be done upon the comparatively expensive machine tools. In answer to inquiries regarding oil furnaces, we have repeatedly referred correspondents to these shops, as there will be found in operation oil furnaces in connection with the bulldozers and bolt machines which, in output per unit of cost of fuel, wages and floor space, will be hard to beat anywhere in this country. For instance, the oil furnace used in connection with the bulldozer is about 6 ft. long and 2 ft. wide. This furnace replaced a coal furnace, which was about 10 × 14 ft., and saves three-quarters of the former expenditure for fuel. The saving due to the introduction of oil heating for bolt furnaces is great, not only in the fuel, but in the bolts themselves. The heating is more uniform, there is less danger of coal shuts and little or no overheating.

The value of the class "H" (Mogul) engine is seen from an inspection of the repair shops. From the mileage of the engines and the class of repairs needed, it is evident that this engine was well designed and is particularly well adapted to the work it has to perform. We have before referred to this engine as being one of the representative modern engines, and as time goes on it is proving to be all that we had anticipated, both in economy of fuel and decreased cost of repairs. In saying this, we estimate the cost of the repairs from the knowledge possessed of the nature of the repairs and the mileage made by the engines. The class "I" (suburban) engine is another very efficient and economical engine. This design is based upon the experience with the class "H." It is a favorite with the engineers, and is one of the very best suburban locomotives yet built in this country.

These shops, like others during these hard times, are running short-handed. This is noticeable in every department. There is a limit to the amount of reduction that can be made in the working force without decreasing the economy; and, while at these shops there may be sufficient help to maintain the efficiency for which they have been famous, yet the limit must be nearly reached.

The new compound locomotive has been completed about three weeks, and has been running for some time on local and way freight, hauling heavy loads. Some indicator cards have been taken from the engines which promise that this compound engine will be one of the most efficient yet built, either in this or in any other country. It is true that the mechanical department of the Burlington road has had the advantage of, and availed itself of, the knowledge and experience obtained on other roads and in other countries with the compound system; but as this engine has been building for a long time the drawings were completed before some of the recent compounds were built; yet the care taken in the design and arrangement of the parts effecting the compound system was such as to place the engine ahead of most others in simplicity and in freedom from back pressure. We have seen cards taken from this engine at 30 miles per hour, with a heavy train, which had less than two pounds back pressure in the low-pressure cylinder, and an almost ideal compression in the high-pressure cylinder. The starting gear is the "Lindner," whose special merit is simplicity, the only additional part being a simple plug cock, which is operated from the reverse lever. So far this gear has given perfect satisfaction, and the locomotive starts trains as readily as any simple engine could. What has not been shown is that even the "Lindner gear" is a necessity. There is no proof yet that any starting gear whatsoever is needed with this particular engine. If this proves to be the case, it would not be too much to say that the compound engine of this type promises to be just what is needed for use on our railroads. This engine is exactly like the class "H," with the addition of the starting gear, except that the cylinders are of different diameters, there being one high-pressure and one low-pressure.

The new, low freight-car designs have been completed, and one car constructed in this way is ready for service. It has the well-known advantages of the Burlington cars in the matter of trusses and general stability; and, besides, it has a superior draw gear, which costs less than the ordinary form, and in the testing machine showed 70 per cent. greater capacity under pulling and pushing stresses. It is made of wrought-iron straps, bent in the bulldozer, and weighs less than one-half of the ordinary forms of draw-bar attachments. The floors of these cars being 9 in. lower than the ordinary form necessitates that the draw bar should pass through the end sills. This is accomplished without weakening these sills or reducing their durability. The draw bars have a wider bearing of the stop against the end sill, and there is provided on that sill a large plate to prevent its being battered away on the draw-bar stop. The new cars are ceiled all the way to the roof to increase the strength and to prevent grain from falling in between the sheathing and the outer covering. As a whole these cars probably have a greater carrying capacity for the same dead weight and height over all than any other cars now built. This progressive step in freight-car designs is the result of the continued endeavor of the mechanical department of this road to furnish a class of specifications and designs that will enable it to keep abreast, if not ahead, of its competitors and give better satisfaction to shippers.

The testing laboratory is overrun with business. Owing to compulsory economy on the part of the railroad company the force has been reduced to two men, the policy of which we do not like to question; but this much is to be said: Economy in small things is often expensive, and if there is any one department on a railroad which needs to be kept to its full efficiency it is the testing department. We think this will appear when the report is made by the committee appointed by the Master Mechanics' Association. The committee has already received replies from a large number of roads which have established testing departments sufficient to show that the cost of such a department bears but a small ratio to the saving to be obtained therefrom. The fact is that, no matter how much business a road may be doing, the labor in a testing department remains about the same, and the large economies in the engineering departments are to be obtained greatly from increasing the scope and usefulness of this department.

Some German Track Tools.

In a recent issue of the *Wochenschrift des Osterreichischen Ingenieur-und Architekten-Vereines* illustrations and descriptions are given of two devices for railroad track adjustment, one of them being known as Bauer's "rail mover," and the other as Geske's "gauge adjuster," and both are said to have been extensively introduced on a number of German railroads.

The former is mainly designed to correct the results of creeping of the rails, and consists essentially of a screw of slight pitch, with right and left hand threads at the two ends. This screw works in two nuts, one at each end, also threaded right and left, respectively, and these nuts are securely fastened to two adjoining rail ends by means of split pins, which pass through holes in the rail webs and wedges. The double-ended screw is hexagonal, head in the middle, permitting the use of a wrench. It will be readily understood that by turning the screw in either one direction or the other there will be a tendency to either separate the rails or to draw them together. One or two men handling a spanner, can in this way bring a comparatively high pressure to bear on the rail ends.

Geske's gauge adjuster comprises a track gauge rod and a lever, the former being of such construction that one end serves as a fulcrum for the lever. The other end of the gauge rod is in the form of a claw, made to grasp one of the rail heads firmly by the aid of wedges. The fulcrum end of the rod is fitted with an adjustable lug projecting downward, marking the proper width of gauge. The end of the short arm of the lever is made to

bear against the rail flange, and when pressure is applied to the long arm the tendency is to move the rail laterally until its head bears against the lug just mentioned. When this occurs, the proper width of gauge has been secured and the rail may be spiked. The principal advantages claimed for the device are its simplicity, and the fact that with its aid ordinary, unskilled workmen can readily line the track to gauge in a perfectly satisfactory manner.

The Friction Brake of the Mount Pilatus Railroad.

Brakes and safety devices for very steep inclines are always interesting, and the one herewith for the Mount Pilatus rack railroad, which has a maximum gradient of 48 per cent., is no exception. Figures 1, 2, 3 and 4 show the construction of a friction brake used on the locomotive operating the above line. There is also, in addition to this brake, a friction brake on the crank shaft of the ocomotive and a compressed air brake.

Two horizontal pinions, shown at *A*, fig. 1, gear into the rack between the rails, as shown in fig. 3. The vertical shafts on which these gears are mounted carry disks on their upper ends, which act as ratchets, as shown at *B*, fig. 2. On these ratchet disks are mounted the loose worm wheels *C*, which are connected by the worm *D*. The proportion of the gearing is 1 to 6, and the worm shaft travels six times as fast as the vertical axes carrying the pinions.

When the engine is rising the grade the ratchets do not work, and the worm wheels remain stationary. Going down the grade the pawls catch in the ratchet, and the worm wheels and worms are rotated. The shaft of the worm *D* is hollow, and through it passes a shaft, to which the worms are keyed with a long feather. This enables the worm to slide endwise to allow for variations in the teeth of the rack. On the inner shaft are disks *E*. These disks are for the purposes of braking, and the brake shoes press thereon, as shown at *F F*, fig. 1. A jet of water passes through the interior of the inner shaft, and through small openings in the circumference of the disk to prevent overheating. The principle of the brake, namely, that of driving a worm by a worm gear, is one which permits a small pressure on the brake shoe to control the speed easily.

An automatic regulator is provided shown in detail at *F*, fig. 4. It operates as follows: Two weights *G G* placed opposite exert a centrifugal force against the spring shown at *H*. When the speed of the train increases beyond the desired point, the weights move outward and strike the lever *J*, which trips the powerful spring *K* and applies the brake shoes automatically. To prevent too sudden application a dash pot is provided at *L*. The pinions are of crucible cast steel, and the worm gears of delta metal.

This gear deserves attention because it is used on one of the steepest lines in the world. It starts at an elevation of 1,440 ft. above sea level and rises to 6,790 in three miles, the average grade being about 42 per cent. The locomotives were built by the Société Suisse, at Winterthur, Switzerland. Their general dimensions of the engines and weights of the car are as follows:

Gauge	31.5 in.
Diameter of cylinders	8.66 "
Stroke of pistons	11.81 "
Diameter of carrying wheels	15.75 "
Diameter of pitch line of toothed driving wheels	16.1 "
Wheel base	240.0 "
Direct heating surface	15.8 sq. ft.
Indirect	209.2 "
Total	226.0 "
Grate area	4.09 "
Steam pressure	12 atmos.
Water in the boiler	1,069 lbs.
" " tank	1,763 "
Fuel	770 "
Weight of the carriage body	2,425 "
" " engine	6½ tons.
" " complete vehicle with 35 persons	10.5 "
Mean speed 65 yds. a min. or 2.2 miles an hour.	
Radius of curves	80 metres.

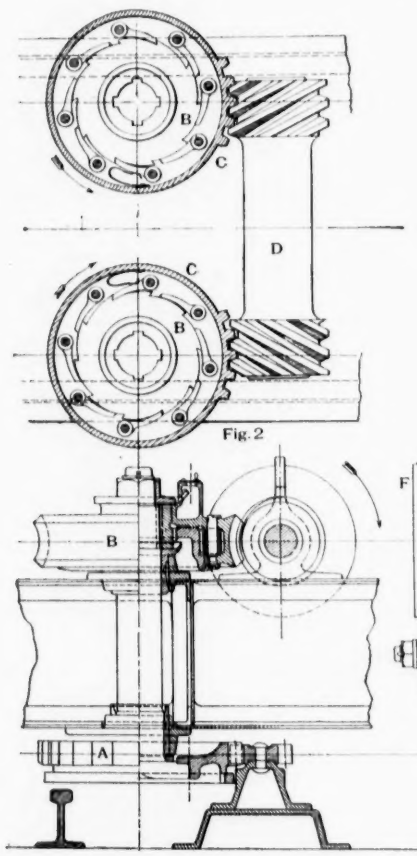


Fig. 2.

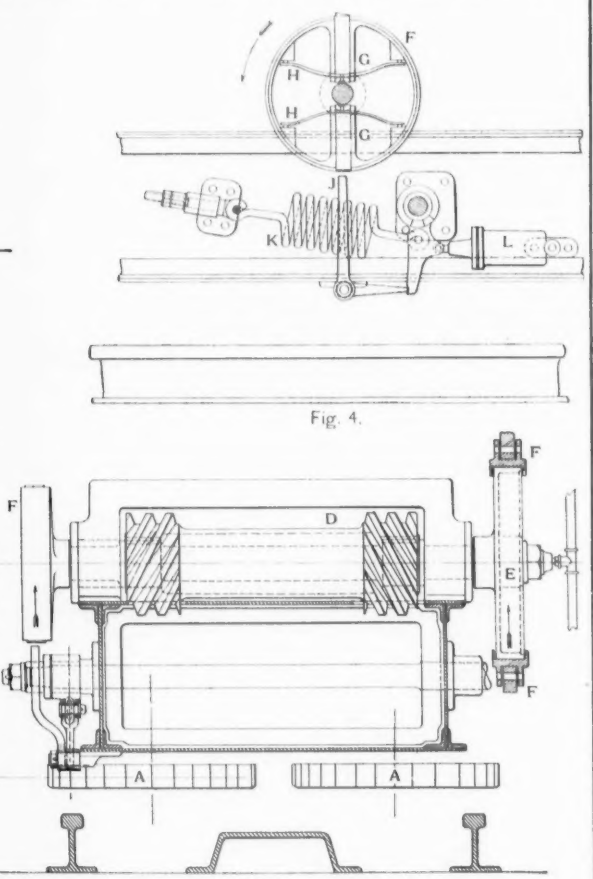


Fig. 1.

FRICTION BRAKE—MOUNT PILATUS RAILROAD.

Fig. 4.

Fig. 3.

Wrecking Outfits and Handling Wrecks.*

BY P. W. HYNES,† WRECKING FOREMAN B. C. R. & N. R. R.

VI.—CLEARING TRACK.

Precisely similar conditions are never found to prevail at two wrecks, and for this reason it would be impossible to lay down a course of procedure to cover all contingencies; but there are certain conditions which are common to all wrecks, and still others which occur very often. Of these we may treat in a general way, and I shall undertake to describe my methods in a few of the operations most frequently met with.

My outfit will consist of the tool car and derrick already described. Between them I place a flat car with pocket stakes on both sides. This car carries four spare trucks, two timbers 8 in. × 16 in. × 14 ft. long, two sawed ties 10 ft. long, and a few rails, splices and track bolts. Behind the tool car is the caboose, which is fitted with lockers, folding side tables, etc., for the use of the men. In this car are carried various small tools and supplies, together with train and hand lamps, torches, oil and waste, and a complete set of telegraph instruments, wire, tools and climbing spurs. In a cellar beneath this car is a small telegraph office and stove in sections.

The entire train is kept standing on a spur at some central point where there are repair shops and the spur is so situated that it cannot be blocked by cars. The best "home" for the wrecking outfit is at the division headquarters, because it will there be under the eye of the superintendent, who can not only inspect it frequently but can better arrange for its prompt departure for the scene of a wreck, for an hour lost in starting is even more serious than an equal delay in the work of clearing the track, since in the latter case the time may be utilized in saving property. In the office of the yardmaster should be kept the addresses of all men composing the wrecking crew. On learning of a wreck of sufficient importance to warrant sending out the train the dispatcher should notify the superintendent, roadmaster, engine dispatcher and yardmaster, giving particulars, if possible. If the wreck is very bad, the Road master will call his men and load such track or bridge material as may be needed. The yardmaster will call the wreck crew and train crew, and will detail the nearest switch engine to make up the train and head it the right way, also attaching to the rear the train caboose. The engine dispatcher will call the engine crew and prepare a powerful engine to draw the train. Steps should also be taken to notify the operator nearest to the wreck to accompany the train, and the section men on whose territory the wreck has occurred should also be called. Such attention should be given to the details of this arrangement as will insure its working under any and all conditions.

At the last siding passed the train should be rearranged so that it may approach the wreck in the following order: Derrick, flat car, engine, tool car, wrecking caboose, train caboose. Arrived at the scene, the first thing to be done is to protect the wreck from both directions, and it will often be found of advantage to leave a flag at the nearest side track on the relief side of the wreck, so that cars may be safely pulled out of the way and stored by the wrecking engine. The wreck foreman will then make a careful survey of the ground, and as soon as the wires can be tapped he should send a detailed report to the superintendent, so that arrangements may be made for carrying on the traffic during the blockade. The telegraph will be found useful in directing the movements of all trains, in asking for materials, and in reporting the progress of the work. It is always a good plan to place on the front end of the derrick car, before closing up to the wreck, such tools as are certain to be needed.

The wrecking foreman, having made a careful investigation of the entire wreck, should plan his work and so dispose his forces as to keep all of them constantly employed. He must guard against accident at all dangerous points, and must know that his men are in safe positions before he gives the word to "make a pull" with the derrick or engine. For this reason it is essential that he alone should give to the trainmen the signal for a movement, and at night it is wise for him to carry a colored lantern to distinguish him from others. The engineer of the locomotive should be constantly attentive and to do good work must have complete control of his engine and be able to make as small a movement as is required. Such trainmen as are not engaged in flagging should serve as repeaters between the foreman and the engineer. The gangs will work much better if they have confidence in the foreman and know that he will attend to their safety.

Frequently there will be a number of cars in the wrecked train a little removed from the "pile" which are but slightly injured. These can usually be placed upon the rails quickly by the use of jacks and hauled to the nearest siding, leaving the track unencumbered. If, as is usual, the draw-heads are broken, they may be chained together, leaving a few feet of slack between each two cars. As fast as the obstructions are removed the ground should be cleared and the track laid down. It is sometimes well to cut a rail and lay 15 ft. at a time, so as to keep the derrick well to the front.

A skillful foreman will not clear up all the cars within reach, but will open a passage way of the proper width to clear trains. Any cars which are piled so near as to be dangerous should be tipped over or blocked securely. There is always an interval of time between the arrival of the wrecking car and the clearing of any part of the track when the track men will be idle. Their attention should be directed during this interval to the unloading of such cars as the wrecking foreman shall indicate, to the sinking of dead-men where they are needed, and to all such work as can be done in advance of the derrick to assist its operation. Great care should be given to the preservation of the freight which is unloaded, and this is often provided for by requiring a freight agent to visit the scene. He can also procure the numbers of all cars and so avoid much confusion in the adjustment of the accounts.

Many roads require the master mechanic or his representative to accompany the wrecking crew in all cases which involve a locomotive, so as to guard against any needless destruction of machinery. The old practice of burning damaged cars by unauthorized persons is now obsolete, I believe, but it has often given rise to heavy losses, and it is pretty sure to demoralize the men and make them wasteful. When the pile is a long one, and cars are lying on top of one another, it is possible to save time by rigging tackles to the top cars and rolling them to one side. If the wreck occurs at a point where the room is limited, and it is necessary to haul the cars out of the pile and ditch them at a distance, the light, easily-handled cars should be taken farthest away and space enough reserved near by for the heavier parts of the wreck.

A burning wreck is a difficult case always, but I had one experience which taught me a good way to quench the flames. A car of merchandise and a car of oil were burning fiercely on the track and were mixed up with a great pile of iron and rubbish. The flames made it difficult to work near the spot until the fire was scattered. This was done by passing a chain 100 ft. long made of short pieces spliced together over the wreck and dragging a pair of wheels through the pile by means of the engine.

A heavy engine should always be provided when pos-

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† This chapter has been somewhat changed in the office of the *Railroad Gazette* and Mr. Hynes is not responsible for all that is said in it.

sible—the jerky work of a small one is exasperating and wasteful. The engineer, too, should understand his business, and upon him, more than any other one thing, depends the success of the work. On double-tracked roads it is generally better to clear one track first, and then take up the work at leisure. And very often it is found possible to build a track temporarily around the wreck in less time than would be required to clear it up. Of course the methods employed will depend somewhat upon the relative values of time and rolling stock. If time is of the first importance, less care can be taken to protect property than if such is not the case. It is always best to provide food and hot coffee to the men if they are to be out for more than six or eight hours, as they will more than repay the outlay in service. The caboose should be fitted with all that is necessary to give the men a plain lunch.

Dimensions of Brake Levers for C., B. & Q. Passenger Cars.

The diagram herewith shows at a glance the length of the brake levers used for passenger cars on the Chicago, Burlington & Quincy. This diagram has been prepared to facilitate the arrangement of levers and the examination of cars to determine the braking power.

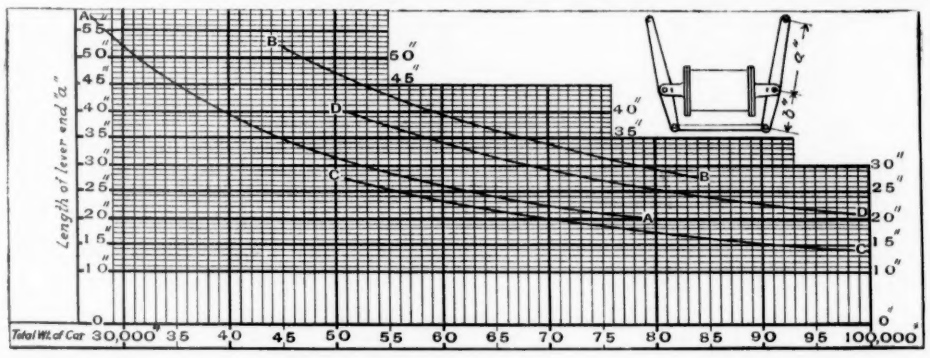


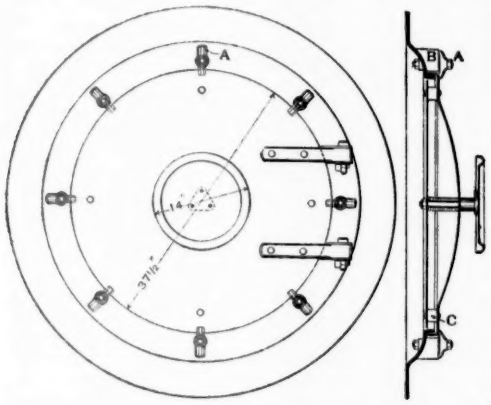
DIAGRAM OF DIMENSIONS FOR CLYINDER BRAKE LEVERS, C., B. & Q. PASSENGER CARS.

Use Curve A A for dimension "a;" cars with 4 wheel truck, 10-in. brake cylinder. b = 15 in.; all wheels braked.
Use Curve B B for dimension "a;" cars with 6-wheel truck, 10-in. brake cylinder. b = 15 in.; four wheels braked.
Use Curve C C for dimension "a;" cars with Truck No. 6, 14-in. brake cylinder. b = 15 in.; all wheels braked.
Use Curve D D for dimension "a;" cars with Trucks No. 4 or 5, 14-in. brake cylinder. b = 11 in.; all wheels braked.
Total brake power, 90 per cent. of weight braked; final cylinder pressure, 60 lbs.

Such a diagram as this is not only of local value but of general interest, as it illustrates a plan which might be followed with advantage by every road having a variety of cars. This diagram explains itself; but it may be well to add that the vertical height from the base line to the curved lines represents the length of the end *a* of the brake levers for cars having different weights, such as are given at the bottom of the diagram.

Fox Solid Pressed Steel Boiler Front.

June 27, 1890, page 454, we illustrated this locomotive boiler front with a fastening at the centre by means of a screw and a bar reaching across the interior. That design has given good results except in a few cases where the extended smoke box was used. In those instances leaks in the cinder pocket caused fires in the front end which warped the front and increased the leakage by the unequal expansion of the door. This might, we think, have been anticipated from experience



gained in the past with cast iron doors fastened at the centre. In all other cases the fronts have remained perfectly tight. To obviate the difficulties incident to leaking cinder pockets, the design in the accompanying illustration has been brought out. The difference lies in the attachments for the door. It is customary in cast iron fronts to employ a number of bolts around the periphery of the door to prevent leakage when the front becomes overheated. All fronts, whether of cast iron or of pressed steel, will warp when there is a fire in the smoke box, and a number of bolts, located as shown, enables the tight closing of the door, even when warped. These fronts are now being used on all of the new elevated road engines, and many of the old ones, in New York City. They are also being used on all of the class "I" engines on the C., B. & Q., and many have been sold in different parts of the country, so that sufficient experience has been had to warrant the manufacturers in pushing for further business. This front has two principal advantages, lightness and smoothness. The weight is only about one-third of that of the cast iron front, and the surface is free from rough spots and pit holes, which are common in cast iron. The buttons shown at *A*, figs. 1 and 2, are made either of malleable iron, drop forgings or pressed steel, as required. The filling block *B* is made of malleable iron. The number plate is attached by a stud, as usual. The hinges are of wrought iron, riveted to the door. The customary lining, shown in fig. 1, is riveted to the door by rivets passing through the thimbles shown at *C*.

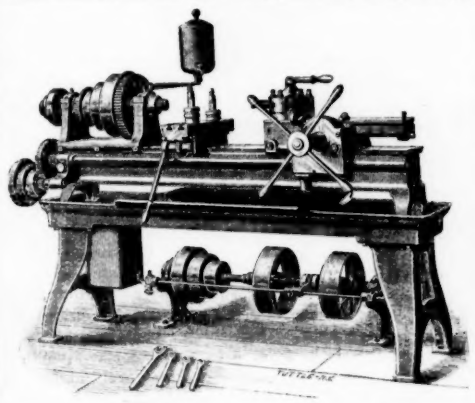
Garvin Machine Co.'s Screw Machine.

The screw machine herewith illustrated is manufactured by the Garvin Machine Co. of New York, who make a large variety of this class of lathes.

This machine is known as No. 3 size, and has 14 in. swing and 4½ ft. bed. It is arranged with power feed and automatic stop. The feed rod and connections are placed on the front of the lathe for convenience in handling. The feed is tripped by means of an adjustable dog carried on top of the turret slide. The spindle has a 1½ in. hole its entire length. Its outer end is threaded for chucks, or is made with automatic spring chucks and wire feed. The spring chucks used have no end motion when gripping stock.

The turret is 8 in. diameter, with eight 1½ in. holes for tools, and has a movement of 12 in. The head is made as shown, with back gears, or with plain cone, or back gears and friction clutch. The friction clutch head admits of changing instantly from fast to slow speeds, or stopping, as desired.

This machine is also made with extra large spindle, when desired, which gives a 2½ in. hole in spindle, or



1⅝ in. hole with wire feed and spring chuck. The pan for chips is especially large and has a side extension where chips accumulate, with oil pot at end, where it is not liable to become clogged. The countershaft has friction pulleys 14 in. diameter and 4 in. face. The weight of the machine, complete, is 1,600 lbs.

The company also make a turret lathe for work where oil is not required. It is made with the same heads, spindles and turret as the No. 3 screw machine, and with plain chuck, spring chuck or wire feed. It is also made with draw-in chuck operated by hand wheel at back of spindle. It is 16 in. swing.

Early German Studies of American Railroads.

I.—FRIEDRICH LIST.

It may seem strange, but it is nevertheless true, that Germany received a strong impulse toward its early railroad construction from America. This was through the eminent political economist Frederick List, who having been a short time a professor in the University of Tübingen, became a leader of the opposition to the government of Würtemburg, and having been elected a member of the parliament was excluded, and condemned to long confinement in a fortress for so-called libel of the administration. He escaped and lived for three years in adjacent countries, but on returning was banished to North America, where he landed in July, 1825, and lived as farmer, contractor, and journalist for five years, in the midst of the eager prosecution of internal improvements—first canals and then railroads—which characterized that period.

As early as 1828 List wrote from Reading, Pa., to an eminent scientific man in Munich, affirming the practicability and the very great advantages of railroads, and his correspondent caused some of these letters to be published. Whereupon List himself presented more at length his views on railroads and canals, in a publication at Hamburg called "News from America." He urged particularly a uniform system of railroads, in opposition to disconnected lines, and expressed the conviction, then not generally held, that such a system would be advantageous for the transportation of coarse goods like coal, stone, timber, iron, cattle and grain, as well as for carrying passengers and merchandise, and would serve, not only to move the existing traffic, but create a new traffic. He was full of zeal, and presented his convictions in clearly intelligible terms. He went so far as to sketch a plan for a considerable railroad system for South Germany, with connections to the north. He warned the Germans against expecting too much from canals, in spite of the great success of the Erie Canal. Only a few canals, he said, could be great successes, and, especially, it might be long before one would become profitable, and in Germany it was of the utmost importance that the first enterprise undertaken should have an early and unmistakable success, as there was great opposition there to such improvements, while they found universal favor in America; and the numerous divisions of Germany and the lines of custom houses on the borders of each little country were a great obstacle to the development of anything more than a neighborhood commerce. Against this system, and in favor of a German customs union, List had already distinguished himself.

While still living in Reading, List sent to King Louis I. of Bavaria these printed articles, also a manuscript on canals and railroads (dated Feb. 5, 1829) and a printed report on his plan for the "Schuylkill Railroad" (probably the present Philadelphia & Reading). The King referred them to a leading engineering authority of the kingdom, with instructions to report on the practicability of such enterprises in Bavaria. The engineer reported in favor of a railroad instead of a projected canal between the Danube and the Main; but this did not avail to change the purpose of the chief government engineer, who was eager to realize what had been a favorite scheme of Charlemagne, to whom, we may suppose, the idea of making a railroad instead had never occurred.

About this time List gave up newspaper work, and in connection with a joint stock company, which had a capital of $700,000, engaged in mining anthracite coal in mines which, a German writer says, he had himself discovered. The business was so successful that soon a railroad was built to connect the mines with the Schuylkill Canal. This was the Tamaqua & Port Clinton Railroad, which was opened in the fall of 1831.

In that same year List returned to Europe and at first settled in Paris, where, in connection with eminent French engineers and economists, he prepared for the *Revue Encyclopédique* the outlines of a national system of transportation for France. He also urged on Belgian authorities the construction of a railroad from Antwerp to Cologne, without success. The next year he brought his family from America and settled in Hamburg, where he found little support for his plans for railroads to connect that port with the interior. In 1833 President Andrew Jackson appointed him United States Consul in Leipsic, the centre of German internal commerce.

Scarcely was he established in Leipsic when he published a pamphlet giving a plan for a Saxon railroad system which should serve as the beginning of a German railroad system, and particularly advocating a railroad from Leipsic to Dresden. This publication attracted great attention. A connected system of railroads was then far from men's thoughts, but in this pamphlet List prophetically declared that "railroads and steam cars are destined to play a part in the history of human inventions no less important than the press and gunpowder; in a word, they will become the circulatory system of the European Continent." To this pamphlet were attached, as an appendix, proposed articles of incorporation, in the American fashion, of a company to build a railroad between Dresden and Leipsic. This pamphlet, doubtless, had much to do with the realization of this latter project, and it was not many years before substantially the whole system sketched in List's pamphlet was constructed; but List at that time was generally held to be a wild enthusiast. Some prominent men in Leipsic, however, including far-seeing and enterprising merchants and scientific men, associated themselves with him and the subject attracted the serious attention of the government. In 1834 List published an "Appeal to our Fellow-citizens in Saxony," in which he supported his advocacy of railroads by citing the great results already attained in America and England. Meanwhile the Dresden & Leipsic railroad was begun, List assisting in

the organization of the company, and in making its plans and reports and in the other preliminary work (as that of securing the right of way) for which his American experience was available. His connection with the company did not last long, however.

This was the first railroad of any considerable length in Germany. It is 72 miles long, and serves a district with a dense population and important industries. It was completed in 1838, and has always been regarded as the practical beginning of the German railroad system.

What List took from America was not so much a knowledge of railroad construction as an unbounded faith in the value of railroads and that enthusiasm in promoting such enterprise which is familiar to all who have lived in those parts of the country not yet provided with railroads. His experience here was in the very earliest days of our railroads, and was probably valuable chiefly because it enabled him to affirm positively, from observation, that such means of transportation conferred very great advantages on the countries they served, and could be profitably employed for all kinds of transportation, and that their construction was justified even in a country very much more thinly peopled than Germany, and which was not altogether proved by their success in England, with its dense population and highly developed industries.

Kelsey and Stevenson's Automatic Switch.

The drawings shown herewith illustrate an apparatus invented by the gentlemen above named, who are connected with the Kelsey Railroad Signal Co., of Florence, Mass., Mr. Kelsey being the General Superintendent. The design of this apparatus is to provide a switch similar to the old-fashioned weighted lever, which is used considerably in the South and elsewhere, for the purpose

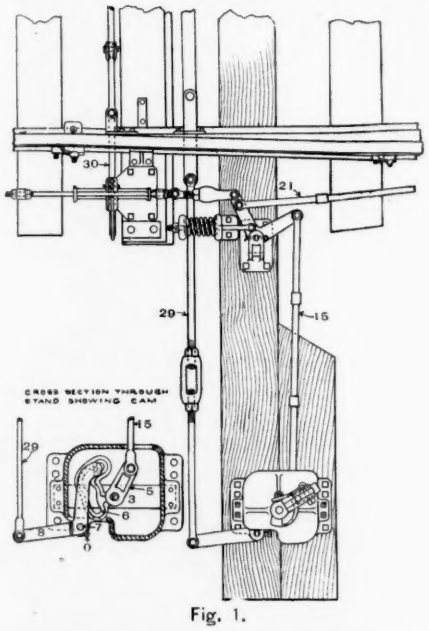


Fig. 1.

of making it impossible, or at least inconvenient, for a switchman to go away from a switch while it is set for the side track. The present device seems to afford a convenient means of doing this, and, in addition to that, is provided with a facing-point lock and detector bar. The construction of the parts will be understood by reference to the drawings figs. 1, 2 and 3.

Fig. 1 is a general plan showing switch set for main

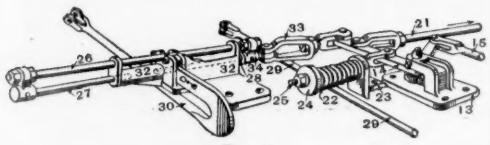


Fig. 2.

line and the switch rails locked. Fig. 2 is a perspective sketch of stretcher bar, plungers, plunger stand and operating parts. Fig. 3 shows switch stand, showing position of handle 4, when the switch is set for the siding. Rod 25, fig. 2, is fulcrumed to crank 14; it passes through spring seat 23, thence through spring 22 and spring cap 24, and has a nut on its end to regulate the tension on the spring. The tendency of this spring is to keep the switch closed and locked for the main line.

The switch handle 4 is pivoted to swing in a vertica plane, in an arm n, which is secured to the switch shaft 3. A pawl, t, is pivoted in the arm n, between the switch handle and the shaft 3, and is formed with a projection v, which extends over the inner end of the handle 4. The top of the switch stand is formed with a notch z, at the point which is immediately under the pawl when the switch is set for the siding. The circumference of the rib g is eccentric to the switch stand, so that, as the handle is turned toward the position in which it here appears, the pawl rides upon the eccentric edge and falls into the notch z when the handle is thrown completely around to the position shown in fig. 3.

The pawl then holds the switch and prevents it from turning so long as the handle is held in a horizontal position; but if the handle is not held up it will drop to a vertical position, and its inner end will lift the projection t of the pawl v, and draw the pawl out of the notch z when the switch shaft will be free to turn by the action of the spring 22, thus restoring the main track.

The automatic working of the switch is optional. By disconnecting the spring 22 and substituting a plain handle which is furnished in place of the handle shown in fig. 3, the switch can be left in either position.

Constructed as described and shown in these drawings, when the switch handle is thrown around to set the switch for the siding, the shaft 3 is turned, and with it the cam 6, fig. 1. On the first part of the stroke cam crank 8 remains stationary; but the cam meanwhile travels and imparts simultaneous movement to the detector bar and plungers, 27 and 28, which unlocks the rails, while the detector bar makes a quarter turn. During the second part of the stroke motion is imparted to the cam crank 8, and this moves switch rod 29, and sets the switch for the siding.

It will be seen that the ends of rods 27 and 28 (shown in dotted lines) are far enough apart to allow sufficient motion of the transverse locking bar between the earlier

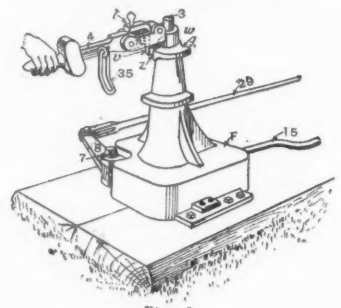


Fig. 3.

and the later portions of the stroke of the switch stand.

On the last part of the stroke the detector bar is dropped below the rail in its reversed position, and plunger 27 locks stretcher bar 30. The detector bar not only holds the points over if through forgetfulness the operator should drop the handle during the passing of a train, but prevents him from throwing the rails between trucks.

Arguments For and Against Compound Locomotives.

In a paper on *The Compound Locomotive* read before the *Société des Ingénieurs Civils*, in 1889, Mr. Ernest Polonceau, Superintendent of Machinery of the Orléans Railroad and Vice-President of the Society, gave many reasons why he did not approve of compound locomotives for general use. These arguments have been recently answered before the same society by Mr. Mallet, the well-known designer of compound locomotives and champion of the system. The following is a condensation of these two arguments for and against the compound locomotive.

Mr. Polonceau says, substantially, that while the compound system gives economical results from marine and large stationary condensing engines, he does not believe that it follows directly that it is advantageous for locomotives. The duty demanded of locomotives is very different from that of stationary and marine engines. The work of locomotives is continually varying, while the compound is especially economical for a constant load and would apparently give little economy for any work other than that for which it was intended. New machines always give economical results while they are new and carefully watched by their inventors or promotors, and when handled by selected operatives, but when they are left to themselves, with the ordinary run of operatives, the saving is not more than half that found in the trials. The author says that he is convinced that the compound system gives economical results but does not believe that, other things being equal, the saving in fuel exceeds from 5 to 8 per cent. But between a good and a mediocre engineman we find differences of as much as 50 per cent., with a mean of from 15 to 20 per cent., and between a locomotive in perfect order and one about to be sent to the shops for repairs the difference often reaches the same figures.

The claim that compound engines are superior in starting is not supported by the facts, and in many cases the contrary is true. As to the claim that sparks are not thrown out on account of the reduced pressure of the exhaust, the same results can be obtained with a variable exhaust nozzle and by avoiding cramped exhaust passages. A saving of 5 per cent., or more, is obtained with the Lencauchez device, by which part of the heat of the escaping steam is returned to the boiler. In regard to the claimed greater stability of compound locomotives, engines with outside cylinders are always less stable than those with inside cylinders, and the latter ought in general to be preferred as being more stable than any form of compound locomotive.

Referring to the claim that the compound lessens the difficulties due to the wire drawing of steam, Mr. Polonceau says, in effect, that this wire drawing, which leads in ordinary locomotives to superheating and hence to cutting the valve faces, can be remedi ed by sufficient lubrication or by means of the Le Chatelier device. The loss in pressure due to wire drawing does not appear to be very great and can be overcome by special valve gears. In regard to the reduced cylinder condensation claimed for compound locomotives, steam at the initial temperature entering the cylinder, just after exhaust has taken place, theoretically comes in contact with a wall at a temperature of about 212 degrees and will be rapidly condensed, thus raising the temperature of the cylinder which, in its turn, will produce an evaporation of water during the expansion which is utilized, and an evaporation during the exhaust which is lost. In locomotives, the thermic effects of compression must be included. In a locomotive at high speed, making from four to five turns per second, this series of phenomena takes place in from $\frac{1}{8}$ to $\frac{1}{10}$ of a second. The result is in reality that locomotive cylinders take a mean temperature from which the variations are very small, and the effects of condensation are wholly different from those which are found in slow speed stationary engines. In compound locomotives the economy which follows from these conditions is balanced by the great condensation which results from the considerable cooling surface in the large cylinders.

The author says that he does not think that the compound locomotive should be abandoned, but his opinion on the subject is that while its use is now compulsory in countries in which fuel is exceptionally dear, and in some special cases, the compound is a complication for locomotives and is therefore not generally desirable. High pressures cannot at present be used in locomotives on account of the imperfection of the valve gears which prevents a sufficient range of expansion. With the compound system the expansion can be more prolonged. The compound locomotive would certainly be theoretically an economical solution, but it would be necessary, as in stationary and marine engines, to be free to give the desired dimensions to the cylinders, and the available space, either between the frames or outside, is insufficient. Mr. Polonceau does not believe that the saving realized in practice compensates for the difficulties of maintenance following from the mechanical complication and the supplementary expenses of lubrication, even for compound locomotives with two cylinders; for notwithstanding all precautions, the work on the two sides is not equal, resulting, evidently, in lost work and more or less rapid wear. As the two-cylinder compound locomotive is then not economical, it is necessary to adopt three or four cylinders, but he thinks that the saving in fuel will scarcely counterbalance the increase in the cost of construction, lubrication and maintenance. Mr. Polonceau concludes by quoting from a paper read before a congress of engineers in November, 1888, in which the conclusions are that the proper field for the compound system is for engines for high powers and constant loads.

In Mr. Mallet's paper, each statement in Mr. Polonceau's paper which is unfavorable to compound locomotives is answered at length. In condensed form Mr. Mallet's reply is substantially as follows: The belief that expansion in successive cylinders is not suitable for variable work is really a prejudice which is unsupported by theory or practice. The work of engines for electric lighting or power, for example, is variable, and yet com pound engines are being applied daily to this class of work with good economical results. Practically, the economy given by compound locomotives, and which it seems difficult to dispute in view of the mass of facts, demonstrates the error of this claim.

The correctness of Mr. Polonceau's remarks concerning new machines is admitted, but they are not more applicable to compound locomotives than to any other machinery, and, reversing the argument, when economical results are obtained from engines in ordinary conditions, with the usual operatives, and after long service, should we not believe doubly in the value of the results obtained? Mr. Polonceau does not give the reasons which led him to fix upon from 5 to 8 per cent. as the maximum saving when reliable investigators have obtained from 15 to 20 per cent. Concerning the difference between good and other enginemen, Mr. Mallet says that the compounds invariably give a considerable economy irrespective of the character of the work, and when handled by many different enginemen, and further, that the regular fuel allowance of the compounds is from 10 to 15 per cent. less than that of ordinary engines on the same class of work. He also refers to a statement of the Superintendent of Motive Power of the Jura-Simplon Railroad, to the effect that, in his opinion, based upon his observations, compound working nullifies to a great extent the influence of the engineman on the consumption of the engine, there being always some expansion, a ratio of 2.3 for example, beyond the control of the engineman.

In regard to the superior starting power, absence of sparks and greater stability which Mr. Polonceau questions, Mr. Mallet thinks that such claims have not really been made, and adds that at first the adversaries of the double expansion locomotive based their objections on these three points: that it would not start, its blast would be insufficient, and its stability defective; but as experience proved that their fears were without foundation, they now contest the *superiority* of the compound, or, in other words, they admit that it is not inferior. With a good starting gear, the compound may be supe-

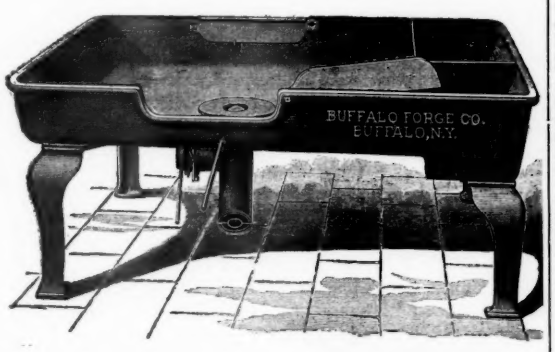
rior in starting to the ordinary engine, as, since short cut-offs are not necessary, the valve gear can readily be made to follow later in full gear. It cannot be denied that the compound, having for the same expansion later admissions in each cylinder, has greater port openings, and hence there is less wire-drawing. The reduction in cylinder condensation is one of the reasons for the economy which is realized by the division of the expansion between two cylinders, and is a fact which is not now open to argument. It is not disputed that the importance of the interchange of heat between the steam and the cylinder walls is modified by the speed of the engine. But Mr. Willans' tests indicate that at 400 revolutions per minute the action of the walls of the cylinders is not annulled, and he concludes that for a high speed non-condensing engine it is advisable to use the compound form even with pressures not exceeding 75 lbs. per square inch. As to the increased condensation due to the larger cylinder in the two-cylinder compound, the sum total of exposed surface is about 25 per cent. greater than in the ordinary engine. With properly protected cylinders, the loss from radiation is estimated at 5 per cent., which shows the compound to be inferior to the ordinary engine by 1.2 per cent.

That the assumed difficulties on account of the large dimensions of the low pressure cylinder in the two-cylinder type are exaggerated is shown by the employment of engines having cylinders from 27.5 to 29.5 in. in diameter. If it is necessary to employ more than two cylinders, it is to secure some advantage besides the saving in fuel, such as increased power or flexibility, for example, or, in other words, a new benefit which will compensate for the increased number of parts. That the compound need not cost more for lubrication than ordinary engines is shown by a case on the Jura-Simplon Railroad, where a compound, which differs from the competing engines only in having a larger cylinder substituted for one of the ordinary ones, used 3.8 per cent. less of lubricants while working on three different divisions and with various crews and making about 22,000 miles.

Mr. Mallet says that 20 years ago he was engaged in defending, before the same society, the cause of compounds as applied to marine engines. The opponents of the innovation employed exactly the same arguments which serve to-day against the compound locomotive. The compound was then a fad which would not last, and now double expansion has nearly disappeared in marine practice, as they predicted, but only to give place to triple expansion. In conclusion, the author quotes Mr. Borodine as saying: "On our lines in Southwest Russia we have had a dozen compound locomotives in use for several years. They are giving such satisfactory results that all locomotives which we build in the future will be of this type."

Buffalo Stationary Blast Forges.

The accompanying illustration shows an improved forge designed by the Buffalo Forge Co. for the Union Pacific road. It is adapted for use in shops provided with fan blast, and to meet the requirements of extra heavy work. The fire has a depth of 8 in., thus admitting of a strong, deep fire necessary for handling large and heavy work. When it is desired to run light work upon the forge provision is made that the gates on the sides can be opened and the fire lowered 4 in. to suit.



The tuyere iron is of a design especially intended to withstand heavy service without burning out, and is fitted with a 3½-in. wind gate or valve for regulating the blast. The water and coal boxes are cast in one piece with the fire pan divided by a sloping partition for the easy removal of coal. In every respect this forge is superior to, handsomer and cheaper than a brick forge. It is equipped with all the conveniences for handling work quickly.

The Rationale of Lubrication.*

The manner in which lubricants effect their purpose, and the conditions most favorable to their efficient action, are matters but little understood. Considering the waste of power in bearings and the unaccountable differences sometimes observed, both in the friction they develop and in their tendency to heat unduly, a better understanding of their behavior is worth striving after. The results of Mr. Beauchamp Tower's late researches have brought the whole matter within the range of comprehension, and relying upon these and upon some observations of my own, I now hope to clear up some of the mystery which invests the subject.

One of the many interesting discoveries made by Mr. Tower was that the surfaces of a thoroughly lubricated bearing were separated so completely by a layer of the lubricant that a pressure gauge connected successively with different points in the surface of the brass, while the journal was working, revealed a variation of pressure from zero at the boundaries of the brass to a maximum at about the centre of its area; at the latter point the pressure greatly exceeded the nominal load per square inch of bearing. The total vertical pressure thus distributed over the surface of a bearing was practically equal to the load upon the journal. There could, therefore, be no doubt that the brass in a manner floated upon a continuous sheet of the lubricating fluid, quite out of contact with the journal, for otherwise the fluid pressure within the layer must have been less than that of the load.

In order to understand what happens under such circumstances, it will be necessary to bear in mind the fundamental facts which were derived from some experiments described in my article on "The Friction of Fluids," which appeared in *Industries*, Vol. VIII., page 415. When one of two parallel surfaces, which are separated by a layer of fluid, moves tangentially with regard to the other, the force required to overcome the frictional resistance offered by the fluid varies as follows when the layer is viscous or when it is very thin, and, of course, when both these conditions are present: (1) Directly as the viscosity of the fluid; (2) directly as the area of the fluid layer; (3) directly as the velocity with which one surface moves relatively to the other in the direction in which the friction is observed; (4) inversely as the thickness of the fluid layer. In the case of an ordinary bearing, for instance, this means that its freedom of motion is proportional to the thickness of the lubricating layer.

The fact, also, that the friction often varies in a capricious way, and with so little apparent agreement with the simple laws of the viscous fluid friction just stated, and the further fact that the solid surfaces become worn, as though they abraded each other by being in contact, may tend to give rise to some skepticism as to whether the friction we are dealing with is really "fluid" friction pure and simple, and especially in the case of such lubricants as graphite, which are not liquids at all; but all these seeming anomalies can be satisfactorily explained without altering our ground. For instance, provided the bearing is never allowed to "seize," and provided the lubricant has no corrosive action on the bearing surfaces, the wear is in proportion to the amount and the relative hardness and coarseness of the solid matter held in suspension by the lubricant. This solid matter, when present in the thin lubricating layer, exerts an erosive action against the surfaces. The finer the particles and the thicker the layer the more harmless this solid matter becomes, because then there is more room for the particles to move harmlessly through the bearing. Hence there is an almost complete absence of wear with the more perfect methods of lubrication.

Whatever may be the initial thickness of the layer of oil carried in between the surfaces by the revolving journal from the oil bath or the oilway at the "on" side, the moment it encounters the pressure due to the load the fluid begins to squeeze out again toward the boundaries so as to become gradually reduced in thickness during its progress through the bearing. The result is that, in effect, the bearing surfaces are separated by a wedge of the lubricating fluid which is continuously driven forward by the rotating journal, and which wedges the surfaces apart, maintaining at the same time, when under favorable conditions, a clear opening by which the lubricant may enter between them. When, therefore, perfect means of effecting the lubrication is employed, an increase in the load causes a decrease in the thickness of the layer, and, of course, a corresponding increase in the friction by causing a more rapid expression of the oil. An increase of speed, on the other hand, increases the layer's thickness, because the wedge is then driven forward more rapidly. But neither of these effects bears any simple proportion to the cause which produces it, because the resistance of the lubricant to expression varies inversely as the cube of the effective thickness of the layer. Two perfectly accurate face plates, as is well known, will glide over each other for a short time after their faces are brought together; this, of course, arises from the temporary presence of an exceedingly thin film of air between the faces. Conversely, when two heavy face plates are pressed together and then one of them is lifted, the lower one will hang for several minutes with no other support than the vacuum, caused by the frictional resistance to the influx of even so mobile a fluid as air through the exceedingly narrow space between the surfaces. The resistance of the layer to expression also depends very materially upon the area and configuration of the opposed surfaces. There is a very remarkable quasi-elastic repulsion, due to the molecular activity of the fluid, exerted against the opposed surfaces, but this will be dealt with when we come to investigate the special properties of "lubricants." There is also the back pressure within the layer due to the frictional resistance to the escape of the lubricant toward the boundaries, which augments very rapidly with the area of the bearing according to the following law: the resistance to the approach of the lubricated surfaces varies, for surfaces which are similar in figure, as the square of the area or as the fourth power of their linear dimensions.

It is evident from this law that, whatever the figure of the surfaces may be, the power of the lubricant to resist expression under the assumed conditions will be greatly diminished if the surface is traversed by grooves, such as misplaced oilways, which cut it up into smaller areas and offer short cuts for the exit of the fluid. A patent exists for a method of increasing the gripping power of belting, which consists in making numerous perforations in the faces of the pulleys. Here the efficiency is due to the increased facilities for the escape of the air which is carried in between the belt and pulley.

It must not, however, be supposed from what has just been said that the bearing which has the greatest area, or which most approaches the square or circle in figure will be the slowest to seize. The lubricant is almost always kept below the normal thickness which it would otherwise attain, either by the scantiness of the supply or the mode of effecting it; and the rate of expression, which is very small in consequence of the thinness of the layer, only affects the quantity of oil in the bearing by what exudes from beneath the *ends* of the brass. So that, under such circumstance, bearings which are relatively long in the axial direction may become the most efficient, and especially when the lubrication is very meagre or intermittent.

There are other things, such as wear, expansion by heat, distortion of the bearing surfaces under varying loads and stresses, etc., which rob the matter of its simplicity, and the only utility of the propositions, which have been worked out above, is to indicate in a general way one or two of the fundamental causes which determine the thickness of the lubricating layer, and which are practically the only causes limiting its thickness when the lubricant is supplied in the most effectual way. These causes, it will be noticed, operate entirely in virtue of the viscosity of the lubricant.

*Condensed from a paper by Mr. R. Snowden in *Industries*.

Rhode Island Railroad Commissioner's Report.

Railroad Commissioner E. L. Freeman, of the "State of Rhode Island and Providence Plantations," has issued his annual report for the year ending Dec. 31, giving statistics of the railroads up to June 30 last. There are 289 miles of track in the state. Three passengers and 10 employés were killed and 3 passengers and 12 employés injured during the year. The three passengers were killed by the wrecking of a passenger train near Providence, Oct. 29, by heavy iron beams, which, loaded on a platform car, swung around and struck the sides of the cars in a moving passenger train. It appears that this serious accident, which was not intelligibly reported at the time, was caused by the freight train, which was carrying the beams, breaking in two and running together again. For this the commissioner blames the conductor of the freight, who was sitting carelessly in his caboose when approaching a large yard. The commissioner is satisfied that the car was loaded "in the usual manner;" but still he finds that such bulky freight is often loaded on flat cars with insufficient precaution against shifting of the load.

Rhode Island has a law under which heating apparatus in passenger cars must be approved by the commission; this law goes into effect Dec. 1 next. The roads reporting already have 443 passenger train cars heated by continuous steam systems. This number would seem to be a large share of all the cars used in the state. The results of continuous heating on Rhode Island roads have been "highly satisfactory; the cars have been more easily ventilated and the temperature has been much more uniform throughout the car." The Providence & Worcester division of the New York, Providence & Boston has recently put up ordinary rope telltales at the overhead bridges in place of the light, swinging wooden arm formerly used. Much of the preparatory work on the important terminal union facilities at Providence has been done and the station building can probably be begun early next summer. The commissioner recommends the passage of laws forbidding trains passing each other at stations or *on grade crossings* [all highway crossings?] and prescribing the height at which bridges must be built over highways which cross under the tracks. The Legislature is asked to pass resolutions urging Congress to take action on the proposed national laws regulating lighting, heating and coupling of cars.

TECHNICAL.

Manufacturing and Business.

The Knitted Mattress Co., of Canton, Mass., has recently filled several orders from the Delaware, Lackawanna & Western for its knitted fabric for stuffing car seats and backs. This fabric is used in place of curled hair, and is giving good satisfaction. A leading road has recently adopted it in place of curled hair after a four-years' comparative test. The cushions and backs of one row of seats of a passenger car were stuffed with the Knitted Mattress Co.'s fabric, while the cushions and backs of the other row in the same car were stuffed with curled hair.

The Ingersoll-Sergeant Drill Co. has opened an office at 60 Queen Victoria street, London, England, for the sale of general mining, tunneling and quarrying machinery.

The automatic temperature regulator of the Consolidated Car-Heating Co. is now in use on cars of the Wagner Palace Car Co., the Boston & Maine, the Maine Central, the Fitchburg, the Delaware & Hudson Canal Co., the Buffalo, Rochester & Pittsburgh and the Baltimore & Ohio railroads. The consolidated fire-proof heater is now in use by the New York, Providence & Boston, the Boston & Maine, the Intercolonial, the Buffalo, Rochester & Pittsburgh, the Lehigh Valley railroads, and the Wagner Palace Car Co.

The general offices of the Q. & C. Co., the successors of the Dunham Mfg. Co., are located in the Phenix Building, Chicago, Rooms 703 to 707. An error was made last week in stating that the offices were in the Rookery Building.

A Bosphorus Bridge.

The old project of a bridge across the Bosphorus, to connect Europe and Asia, and first broached more than 25 years ago by the Austrian engineer Von Ruppert, has, of late, again come to the front. A design for a bridge, prepared by the firm Giano & Gouvree, is now being considered by the Turkish government. It specifies a length, including the approaches, of 2,000 metres (about 6,560 feet), with draw spans. The height of the bridge above the sea level is to be 40 metres (about 131.2 feet). On the Asiatic side it is proposed to build extensive docks and elevator plants in connection with the bridge terminal. Incidentally it is mentioned that the harbor of Constantinople is used annually by about 37,000 vessels.

St. Clair Tunnel.

The roadbed has been completed along the whole length of the tunnel, the rails and guard rails laid, the brick lining finished, and workmen are plastering the face of the brickwork with cement. Outside, the masonry at the portals is far advanced, but the excavations on the approaches are still a long way from completion. Last week a landslide occurred at the approach to the tunnel on the Canadian side, and near the portal. Nothing connected with the tunnel was affected, and it is simply a question of removing dirt. There has been considerable delay in completing the work, and 300 extra men are to be taken on.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

It is hard to see how the reciprocity agreement with Brazil will help our makers of railroad machinery and supplies. Steel rails, locomotives of the American type, machine tools of all sorts, axles and car wheels are now made cheaper in Europe than in the United States, excepting only wood working tools and cast iron wheels. Ocean freights from Europe to Brazil are far less than they are from the United States, because there are always plenty of vessels in European ports seeking cargoes from Brazil, while between the United States and Brazil the conditions are exactly reversed. We have often known of New York contractors for railroad supplies and machine tools buying the material in England with which to fill their Brazilian orders, and it is not likely that a reduction of 25 per cent. in the Brazilian tariff would enable us to compete in that market even if we alone could hope to profit by that reduction to the exclusion of other countries. Those who have lived among and dealt with the Brazilians know them to be a people of shrewd and good judgment in business matters. The reciprocity agreement in itself is a sufficient evidence of the business shrewdness of the Brazilians who have negotiated it. It is not probable that they will forego any of the benefits of low prices in Europe or give up the trade which helps develop their own shipping interests for any sentimental considerations.

The Value of Railroad Securities.

Of the many financial reviews of the past year, perhaps the most valuable are those of Mr. J. P. Meany, editor of Poor's Manual, taking into account as they do a longer series of years than those of the average writer and a wider range of important facts. Some of his results have an almost startling interest. In a table prepared originally for the Boston *Herald* he shows the fluctuations in value during the past year of the stocks of 85 railroad companies, having an aggregate mileage, excluding all leased and operated lines, of 83,464 miles, or about one-half the total mileage of the country. The total par value of their stocks is $1,948,690,400; of all railroad stocks on the New York Stock Exchange, $2,049,608,260. On May 27, 1890, the average market price per share ($100) of the aforementioned $1,948,690,400 was 60.05, which average was an advance of 7.57 per cent. from the lowest prices recorded earlier in the year. On this basis these stocks were valued in the market at $1,179,214,240. During the recent panic the decline averaged 16.78 per cent. per share, reducing the average market valuation to 43.27 per cent., at which price the securities mentioned were valued at $843,198,336. In a similar table published in the New York *Sun* of Jan. 12, he deals with the more important railroad bonds listed on the New York Stock Exchange. Their par value was $1,813,000,000; their average price at the period of high prices in the spring, 103.4; the average during the panic, 93.0—a decline of 10.4, representing an aggregate shrinkage of $209,000,000. The mileage covered by these bonds was 87,665, or a little larger than that of the stocks above quoted.

These figures, representing as they do over half the railroad mileage of the country, indicate that the stocks outstanding in the hands of the public have, instead of their nominal value of somewhat under $4,000,000,000, an actual value of under $2,000,000,000, and that the outstanding bonds, instead of amounting to something like $4,500,000,000, amount to little over $4,000,000,000; making the effective valuation of the railroads of the country decidedly less than $6,000,000,000, or only about $37,000 per mile. Yet even these figures, small as they are, are large as compared with the amount actually available for interest and dividends. A table taken with but slight modifications from Poor's Manual, for the past fourteen years, shows the following results:

	Interest paid.	Dividends paid.
1876	$93,559,573	$68,039,668
1877	98,820,927	58,556,312
1878	103,160,512	53,629,308
1879	112,237,515	61,681,470
1880	107,866,328	77,115,371
1881	128,587,302	93,344,190
1882	154,295,380	102,031,431
1883	173,139,064	102,052,548
1884	178,058,382	94,411,835
1885	187,426,035	77,672,105
1886	189,036,304	81,654,138
1887	203,790,352	91,573,458
1888	207,124,288	80,243,041
1889	219,877,150	81,264,029

1890 is likely to show some improvement over 1889, but not a very large one.

These figures are larger than those usually given by financial papers; but it must be remembered that the latter include in their returns no small amounts of telegraph and miscellaneous stock.

An examination of these tables shows that, while the aggregate of interest paid on bonds increases steadily, the rate of interest diminishes. From 1882 to 1887 inclusive it averaged over 4.7 per cent. In 1888 and 1889 it was less than 4.4 per cent. Dividend payments, meantime, have of late years been diminishing absolutely; while relatively to the amount of stock the loss is enormous, represented by the following figures:

1882	2.91 per cent.
1883	2.75 per cent.
1884	2.48 per cent.
1885	2.02 per cent.
1886	2.04 per cent.
1887	2.18 per cent.
1888	1.77 per cent.
1889	1.77 per cent.

If we compare the interest and dividends paid in 1889 with the valuation of bonds and stocks in 1890, we shall find that they amounted to just about five per cent. on the total valuation given for the securities. The interest on bonds forms about 5¼ per cent. of the estimated bond values, but the dividends on stock, curiously enough, only four per cent. on the estimated stock value. These facts show that from the investor's standpoint the stock valuations during the time of the depression itself were not so unduly low as some people suppose. Of course a part of this valuation of the principal is due to the hope of better times and to the belief that four-per-cent. dividends on the investment represent a minimum; but a part also, and a very significant part, is due to the fact that the holding of these securities represents value for the purpose of control to some other than the legitimate investor. So long as this value for the sake of control exists, so long must railroads, in the majority of cases, be an unprofitable investment to those who buy them for the sake of security.

Mr. Meany's diagnosis of the case is: (1) that stock-watering has no effect whatever in raising rates; that the latter question is governed wholly by natural causes over which individuals have no control; (2) that the Interstate Commerce Law, bad as it is in its present shape, might, by intelligent and concerted action, be availed of as a means of escape from the demoralizing and repressive legislation of the West; that by securing wise amendments, based somewhat on the lines of the better features of the State Commission laws of Massachusetts and New York, many evils that now harass the railroad interest — such as indiscriminate rate-cutting, unnecessary construction, etc.— might be remedied, if not wholly removed; (3) that the new Presidents' Agreement will be largely abortive—due to the animosity it is sure to create throughout the Farmers' Alliance States, wherein it is now viewed as being without the pale of law. His remedies are, in general, that all inside cliques should be rooted out by public condemnation; that the authorities of the different roads should agree not to build any more railroads for the present, and that where exceptions were made, as they necessarily must be, to this sweeping proposal, the counties through which the lines were built should be required to guarantee interest for a reasonable period.

We agree with his diagnosis more fully than with his remedies. Not but what we should like to see the latter carried out, but that for the present we do not believe them practicable. It is to themselves that the investors must look for protection, rather than to the action of the public, or to an agreement on the part of the presidents with one another and with the localities benefited. As long as there are bad railroad presidents and managers in office they will try to convert to their own uses whatever funds they can get. Public condemnation will not "crush them under its heel," to quote Mr. Meany's expression, half so fast as the stoppage of supplies will starve them out. If investors learn to intrust their money only to those roads where the character of the officials and the success of railroad operation can furnish them proper guaranties, then the greatest evil under which we have to suffer will be much lessened. In the absence of any such caution on the part of investors, an agreement between the presidents of different lines would mean that the good ones would stop building and the bad ones take the opportunity to occupy the field. With wise action on the part of the investors the case would be precisely reversed; and if any guaranty could be obtained from states and counties benefited, it would be worth many times more, if given to the class of railroad presidents who could be really trusted, than if given to those who would manage to convert that as well as everything else to their own use.

The Railroads and Highway Improvement.

The agitation for better country roads, which has begun in many of the older states of the Union, appeals, of course, to all intelligent persons and will, no doubt, receive from most of them what is called moral support, if nothing more; yet it may be that something more than this could be given by railroad officers with advantage to their companies as well as with benefit to the contiguous communities where such improvements of highways are proposed.

It is no longer necessary to prove by arguments that whatever tends to the advantage of the population living along any line of railroad must also incidentally result in benefit to the business of that railroad, for this proposition has received a practical demonstration upon almost every mile of road in the country; but there will not be wanting some to whom the matter of the improvement of common roads will seem to be one as to which a railroad company might properly be indifferent. It is for this reason that we wish to point out some of the reasons why railroad companies should take a lively interest in promoting the construction of good roads.

Over large portions of the most thickly settled farming country, the sum of the time when the roads are good enough to permit of the comfortable hauling of loads to the stations does not average four whole months in any year. At other seasons, as in the fall and spring, when the crops are ready to be moved and the fertilizers should be hauled out from the railroad stations to the farms, the roads are generally in a state to compel taking not more than half a load. Indeed, in the clayey regions, which probably include one-half the area of the United States, the business of the community is practically stopped during two whole months of the year, in the spring, when "the frost is coming out," which means, while the air dries up the water with which the muddy roads have been saturated in the autumn and winter.

Now the interest of the railroad companies in changing this condition of affairs lies in the fact that the transportation of freight, which has been interrupted by it, and which they would have had as an occupation for their rolling stock, can never be recovered. The dry roads will come too late; the demand for supplies which existed and the markets which were open at the time when the roads were too soft for use will have been filled from other sources, and it will be only some, perhaps, less active and subsequent demand which the railroad in question will be called to fill. So the road will have lost a big part of sixty days' work out of three hundred and sixty-five; for the railroad officer and the farmer may both be assured that the rest of the world is not standing idly by while they are waiting for the sun and wind to dry up the mud. On the contrary, all the farmers and all the railroads where hard roads or gravelly soils prevail are as busy as they can be, pouring grain and produce into the markets which the muddy regions cannot supply.

A remarkable instance of the relations of supply and demand was afforded by the great strike of 1877, which interrupted for ten days the deliveries into the Eastern cities of the customary provisions from the

West. As the strike was prolonged beyond the usual three or four days, many began to conjecture that the East would suffer from a famine, that prices would rise and that on the resumption of traffic by the trunk lines there would be a prodigious increase of business in order to fill up the great void caused by the strike. But the East did not reach this condition; its daily wants were supplied from elsewhere, and the trunk lines were short of the earnings which they might have made, just as if the days had dropped out of the calendar.

The annual losses to the farmers by reason of the increased cost of teaming due to bad roads has been estimated at millions of dollars, which does not include any allowances on account of the loss of a market. No doubt the losses of the railroads in revenue which might be earned is another equal sum; so that an immediate benefit for each party concerned may be anticipated from the first expenditure upon highways which results in real improvement. Of course, in most instances the work should begin at the railroad station and extend outwards, and a permanently good road should be built as far as the appropriation will permit; for to build anything less than a permanent road will be a useless waste of money, because, a bad season will cause its destruction where there is any heavy hauling.

If any railroad manager fears that he may establish some dangerous precedent by direct contributions toward highway improvements, he can render equally efficient assistance by making the most liberal rates for transportation of gravel, brick, drain tiles, broken stone, etc., which, in a large part of the territory of which we have been speaking, can only be procured from some distant point by rail.

While on the topic of roads, will it be thought too personal if we suggest that those within the railroad grounds, and more especially those leading to the railroad freight stations, ought to be models of good highways? This, in the first place, because the railroad company invites hauling of the heaviest kind upon them, for its own benefit; and secondly, because the company can thereby give an object lesson to the farming community and show conclusively that a good road may be maintained under heavy usage upon a bad soil. Having engineers in their employ, access to suitable materials, and transportation available, there is no reasonable excuse for a soft road upon the station grounds of a railroad company.

Errors in Theories of Radial Trucks.

It is strange, after all the experience which been had in this county with the radial truck for locomotives, that the device is not better understood by those who have been conversant with its action for years. An illustration of this may be found in the columns of a contemporary, in an article which gives impossible functions to the details of such trucks. The following is a quotation:

> To enable the pony truck to lead properly and guide the engine, to relieve the strains on outside forward driver, also to reduce this source of flange wear and consequent liability to shock from impact of this wheel against the rail on entering a curve, it is necessary that the radius bar should be somewhat shorter than the exact geometrical or radial position, causing the rear end of the radius bar to move toward the outside rail, creating a tendency to run toward the inside of the rail. It is, therefore, obvious that if the bar is too long the drivers will show excessive flange wear; if too short this wear will be noticed in the truck flanges, and the problem at hand is: What is the proper length to equalize or divide this wear between the forward drivers and the truck wheels? This leads us to the point of how the correct length can be determined, and of this location there exists considerable difference of opinion, and this is a question where experience is of paramount importance. The writer, however, is disposed to concur with Wellington "that no strong tendency in the pony axle to run toward the inside rail is necessary, but only just enough to insure the driving-wheel base shall, in fact, modify its natural path, by however little, since if any force whatever needs to be applied to cause the pony axle to roll in the curve, it must necessarily be adequate to slip the wheels on the rails. The stress necessary to slip them a little is as great as to slip them a great deal. To slide the wheels, as to lift a weight, the $\frac{1}{1000}$ of an inch requires as great a static force in pounds as to slide a foot or a mile. The power consumed varies with the distance moved, but the force required to produce motion does not vary." The swinging links can be made to very materially assist to the extent of being so designed as to utilize the force due to leverage in addition to the dead weight suspended therefrom.

The writer fails to allot to the two fundamental features of the radial truck their proper functions. These features are the radius bar, the function of which is to maintain the truck axle normal to the curve, and the lateral motion, the function of which is to guide the engine around the curve. Practically, the radius bar has nothing whatever to do with guiding the engine, neither has the lateral motion anything to do with maintaining the truck axle normal to the curve. Hence, these features are independent, and one can be varied without requiring a variation of the other. Perhaps an elementary explanation of the action of a radial truck would not be out of place here to show exactly what its office is.

Imagine a locomotive truck without the radius bar or a radial axle box (these being equivalents so far as guiding the truck axle is concerned) entering a curve; the truck wheels would cramp in the curve. The radius bar or the radial axle box modifies the position of the truck in such a way that the axle is kept normal to the curve, and is prevented from cramping. If the curvature of the radial axle box be incorrect, or the radius bar be too short or too long, the truck axle will not be kept normal to the curve, but will tend to roll toward the inner or outer curve, as the case may be. This will do no harm if it is not carried to excess; if it is, there will be a tendency to grind the flanges of the truck wheels, and to increase the resistance of the truck in passing curves. The truck, by means of the radius bar or radial axle box, does not guide the engine around the curve. Rather the truck is itself guided around the curve by the radial feature. If the radius bar or the radial axle box be of such length or curvature as to keep the axle normal to the curve, the truck passes freely around and offers but little resistance. If the radius bar be not of the right length, or the axle box not of the right curvature, the truck offers considerable resistance and causes a backward thrust on the radius bar pin. This thrust is not directly in line with the engine, because of the curvature, and therefore it has a lateral component tending to push the front of the engine toward the outer rail. An extreme case of this sort will serve for illustration: Supposing on a sharp curve the radius bar to be so short as to cramp the truck wheels in the rails. The result would be to throw the front of the engine outside of the track.

If a locomotive were pulled around a curve by the engine truck, making the wheels of that truck act as driving wheels, then it would overcome its own resistance and the pulling of the truck on the radius bar pin would tend in a slight degree to haul the front of the locomotive toward the inner rail and assist in guiding the engine; but no such case exists in practice. A little thought will bring out the parallelism between the assumption that a radial truck guides an engine by means of the radius bar or box and the lifting of one's self by one's boot-straps.

As a locomotive enters a curve, the truck moves inward, away from the centre line of the engine; or, what is the same thing, the centre of the engine moves outside of the centre of the truck. To guide the engine around a curve and relieve the lateral pressure on the front driving wheels, it is necessary that some resistance be offered to the lateral separation of the truck and the engine. This is accomplished by the introduction of swinging links, springs, or inclined planes, as fully described in the *Railroad Gazette*, Aug. 22, 29, and Sept. 5, 1890, where this subject was considered at length. The point of application of this resistance is close to the front of the engine, and gives to whatever pressure is there applied a considerable leverage to pull the engine laterally and relieve the thrust on the forward driving wheel flanges. The lateral motion feature of the radial truck, then, is what guides the locomotive. Even supposing the assumption made by our contemporary to be true, that there is a guiding effect resulting from the use of a radius bar shorter than that which would keep the axle normal to the curve, such guiding effect would be applied, not at the centre of the truck, but at the radius bar pin, which is so far back in the engine as to have little or no leverage in its favor, and hence the same amount of force would be much less effective than if applied at the centre of the truck.

No class of trucks has been so badly arranged as the radial trucks. They have suffered from all manner of bad theories. Their construction is not complicated, and the true theory of their action is simple. It may be stated thus: The radius bar or radial axle box has only one office, and that is to guide the truck axle. The swinging or other lateral motion has only one office, and that is to guide the engine. These features are totally independent, and should be considered separately.

The absurdity of making the radius bar or the radius of the curvature of the radial axle box different from what it should be to keep the axle normal to the curve is seen in another way. If the axle is not normal to the curve, then the wheel flanges will not bear flat against the rail, but only on a small point where the curve of the flange touches the rail. This reduces enormously the effective bearing area of the truck wheel flange against the rail, and induces sharp flanges. Several roads have given much consideration to the distribution of the lateral pressure, and they are now watching the effect of changes in the lateral resistance of the truck over the flange wear of the front drivers. Flange wear is, of course, a necessity where engines are passing curves. With the radial truck engine, the wear can be almost entirely thrown upon the truck wheel flanges by increasing the lateral resistance of the truck, or it can be thrown on the driving wheel flanges by decreasing the lateral resistance of the truck. A proper distribution of the wear between the two sets of flanges can only be obtained by changing the method of hanging the truck, and not by altering or changing in any way the radius bar. It is scarcely necessary to go into the mathematics of this question, as there is nothing to be gained by it; but any one who has an interest in the subject can readily determine for himself the fallacy of much of the recent discussion if he will lay down on paper the driving and truck wheels of a locomotive, remembering meanwhile that the locomotive pushes the truck, and that it is not the truck which pulls the locomotive.

Notes on a Northwestern Railroad.

A journey from Chicago to St. Paul and back, both ways by night, does not give one much chance to see the Chicago, Milwaukee & St. Paul road, but it gives a glimpse of the sleeping car service, which, as the reader knows, that road has taken into its own hands. The crack trains are No. 1, leaving Chicago at 5:30 p. m., and No. 4, leaving St. Paul at 8 p. m. These trains consist of eight cars through and nine cars between Chicago and Milwaukee. The distance from Chicago to St. Paul is 410 miles, and the time is 14 hours up and 13½ hours down. The best average, therefore, is but a little over 30 miles an hour, including 20 scheduled stops. For two of these stops 20 minutes must be deducted, and doubtless one hour should be taken off the running time for all the regular stops. This, however, gives a speed in motion of but 32.8 miles, so that after all the "St. Paul" does not have to work very hard to maintain its quickest service between the two cities. A quicker train is run every day each way, the fast mail, Nos. 55 and 56. These trains make the run in 12 hours and 20 minutes, or at the speed of 33.3 miles per hour, including stops. Excluding 20 regular stops, the running time would be about 36 miles per hour. These are the fastest trains run between Chicago and St. Paul, and are said to be the most regular running trains on the road. They carry coaches, but no sleepers. One reason why Nos. 1 and 4 are not run at the same speed is that the present hours of arrival and departure are convenient, and there is no particular demand, unless it may be glory, for shortening the time.

The fastest trains by the other lines are:

	Time.	Distance, miles.	Inclusive speed.	Regular stops.
C. & N. W.....	13 h. 25 m.	409.9	30.6 m. p. h.	25
Kansas City.....	13 h. 30 m.	420	31.1 "	23
C. B. & N	13 h. 30 m.	442	32.7 "	31
Wis. Central.....	14 h. 44 m.	462	31.4 "	26

A comparison of the sleeping car service between the St. Paul and the usual Pullman cars can hardly be made with such limited experience. Aside from one particular, to be mentioned later, the St. Paul is not markedly better than the Pullman. There appears to be more civility on the part of sleeping car porters and conductors; and if this lasts the public will certainly be grateful for the change. There was room for it. The dining car service is perhaps a little below the best Pullman service, not in the variety, but in the details of service; but here again there seems to be more effort to be civil to the passengers.

The one point in which these trains are unquestionably very superior to any others is the lighting. They carry the "light and heat tender" described in the *Railroad Gazette* last summer, and are lit by electricity. All the sleepers have the Gibbs berth lamp, also shown some months ago in the *Railroad Gazette*. Probably the reader remembers that the light and heat tender is an iron car carrying a boiler, a Westinghouse engine and a dynamo The boiler supplies steam for heating and for running the dynamo.

For the passengers the result is very agreeable. The economical result will probably be discussed before the Western Railway Club very soon by Mr. Gibbs. The berth lamp is certainly a comfort. A lamp is placed at the side of the car, just above the back of the seat, between each two adjoining sections. The light falls over one's shoulder in a convenient position for reading, and can be shut off at the will of the passenger by simply letting down a metal shade. When the shades are down on both sides of any one lamp it is cut out.

This method of lighting is the experiment of greatest mechanical interest now being worked out on these fine trains. We cannot now attempt any comparison of its cost with the cost of an equal illumination by either the Pintsch or the gasoline gas. Kerosene, although undoubtedly cheaper, we will leave out of the question entirely, for reasons that hardly need to be mentioned. The competition for first-class service must be between electricity and gas. Both give beautiful results and at equal cost electricity will have a slight advantage in its greater flexibility; that is, electric lamps can be put in convenient corners where gas lamps cannot be put. On the other hand, a car can be so perfectly lighted with gas that berth lamps are a superfluity.

Train Accidents in 1890.

The large table printed herewith gives the usual annual summary of train accidents as published in the *Railroad Gazette* monthly during the year, together with figures by which comparisons may be made for the 18 years that these records have been kept. The classification adopted in the table is such that little, if any, comment is needed.

The casualties to passengers and employés may best be studied by means of the statement by months printed below the large table. As we pointed out in reviewing the annual report of the statistician of the Interstate Commerce Commission (see *Railroad Gazette*, June 13, 1890), the style of classification adopted in the government report is such that but few comparisons can be made between the Washington record and ours. The terms "collision" and "derailment" are used more comprehensively in our record than in that, and embrace many accidents which are there classed under a different head. "Other train accidents" in the government report evidently includes many which do not strictly come within the meaning of that term. This being the case, the monthly table just referred to is perhaps the best available arrangement of our figures for comparison with those of the other report. The government reports being made for the year ending June 30, it will be necessary to take the latter half of the table in our previous annual record and add to it the first half of the present table. The government report for the last fiscal year has not yet been issued.

CASUALTIES TO PASSENGERS AND EMPLOYÉS IN TRAIN ACCIDENTS IN 1890.

Tabulated Ac cording to Classes of Causes.

Month.	Defects of road.				Defects of equipment.				Negligence in operating.				Unforeseen obstructions and maliciousness.				Unexplained.				Total.			
	Pass.		Emp.		Pass.		Emp.		Pass.		Emp.		Pass.		Emp.		Pass.		Emp.		Pass.		Emp.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
January	7	32	4	6	....	8	2	8	7	34	29	82	....	16	10	14	....	12	1	13	14	102	72	123
February	....	11	16	23	....	3	1	3	....	35	27	61	....	....	....	14	....	16	6	10	....	65	50	111
March	....	10	2	5	....	3	....	9	7	44	22	53	....	10	6	11	....	....	5	14	7	67	35	95
April	....	....	2	8	....	....	....	4	2	28	8	44	....	16	....	5	....	15	3	20	2	59	13	81
May	....	....	7	6	....	....	6	5	16	31	23	70	....	4	1	13	3	1	6	8	19	36	43	102
June	1	49	5	....	1	24	5	1	9	47	14	77	....	....	4	5	3	33	13	15	14	153	41	98
July	....	9	1	5	2	2	2	3	10	64	34	77	....	16	9	28	1	6	1	3	13	97	47	116
August	....	2	3	25	1	8	3	9	29	80	35	102	....	....	10	26	....	2	14	34	30	97	65	196
September	3	35	6	12	....	....	3	4	13	48	44	112	24	36	11	15	1	53	9	21	41	172	73	164
October	1	6	3	16	....	27	5	16	6	85	53	139	....	1	5	16	2	16	5	17	9	165	71	204
November	1	30	8	13	....	3	1	9	9	89	30	89	....	....	....	2	....	16	5	12	10	138	44	125
December	6	11	4	7	....	8	2	6	7	39	18	53	....	4	4	13	....	16	7	25	13	78	35	104
Year	19	195	61	126	4	86	30	77	115	624	337	959	24	103	60	165	10	216	81	192	172	1224	569	1519
Year 1889	16	167	30	81	7	58	24	63	46	291	189	595	34	107	53	120	5	122	40	119	108	745	336	978
Year 1888	5	195	45	153	16	65	35	92	92	388	217	573	11	106	77	163	44	258	60	117	168	1012	434	1098
Year 1887	139	406	48	142	11	50	39	57	48	279	218	486	*	*	*	*	9	181	101	205	207	916	406	890

* Included in unexplained.

TRAIN ACCIDENTS—THEIR NATURE AND CAUSES FOR EIGHTEEN YEARS.

	1890.	1889.	1888.	1887.	1886.	1885.	1884	1883.	1882.	1881.	1880.	1879.	1878.	1873-7.†
TRAIN MILEAGE in the United States in millions of train miles*	767.6	723.8	688.8	644.0	569.8	560.2	541.3	538.0	476.0	.....	.....	.....	.....	.....
COLLISIONS:														
Rear	495	379	404	362	338	316	288	413	388	366	274	206	142	155
Butting	323	260	311	309	127	120	138	177	160	146	141	86	70	96
Crossing and miscellaneous	223	110	89	29	36	28	27	39	33	24	22	19	8	43
Total collisions	1,041	749	804	700	501	464	445	630	581	536	437	310	220	295
DERAILMENTS:														
Broken rail	38	32	51	56	45	102	60	84	37	85	45	56	17	71
Loose or spread rail	44	28	42	31	81	65	68	88	72	29	21	19	29	31
Broken bridge or trestle	38	42	40	39	20	32	34	35	38	44	16	17	21	24
Broken or defective switch	33	10	29	23	7	13	9	12	2	5	5	2	1	9
Broken or defective frog	12	7	16	7	20	11	11	7	4	2	2	.....	2	5
Other defects of road	2	1	1	2	1	.....	.....	1	3	4	.....	.....	2	9
Total defects of road	167	120	189	152	174	223	182	227	153	169	89	94	72	149
Broken wheel	37	28	48	27	37	41	22	40	35	58	21	21	5	22
Broken axle	59	48	44	45	62	48	30	60	52	50	30	30	18	32
Broken truck	25	20	27	8	14	18	12	24	14	10	7	11	13	10
Failure of coupling or draw-bar	7	5	7	4	3	6	3	2	.....	.....	1	2	4	4
Fall of brake-beam	12	9	9	10	6	10	.....	.....	.....	.....	.....	.....	.....	3
Other defects of equipment	18	10	13	6	.....	.....	.....	3	3	6	5	2	1	4
Total defects of equipment	158	120	148	100	122	123	67	129	102	124	64	66	41	76
Misplaced switch	54	54	70	49	68	55	82	89	90	85	80	80	48	76
Rail (or bridge) removed for repairs	8	10	3	4	4	4	2	9	2	12	94	4	5	9
Runaway engine or train	19	8	14	6	2	.....	3	1	2	1	5	1	2	2
Open draw	5	1	4	3	2	5	5	4	6	2	1	2	4	4
Bad switching	3	8	18	12	.....	.....	2	9	1	4	7	3	6	5
Other negligence	19	11	8	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Total negligence in operating	108	92	117	74	76	64	94	112	101	104	98	90	65	97
Cattle on track	56	41	57	32	38	25	28	45	48	42	43	35	30	48
Snow or ice	6	5	22	6	27	30	7	13	5	15	8	22	13	20
Wash-out	18	20	19	11	23	22	25	25	23	18	17	11	36	28
Land slide	28	24	34	16	21	7	18	16	7	14	4	7	4	6
Accidental obstruction	28	8	20	31	17	17	42	53	37	45	25	24	26	38
Malicious obstruction	26	20	14	12	15	15	12	12	17	13	8	11	15	15
Rail or switch purposely misplaced	19	5	22	12	24	13	17	16	.....	.....	.....	.....	.....	.....
Other unforeseen obstructions	13	8	5	9	4	6	3	19	7	3	3	3	1	2
Total unforeseen obstructions	194	131	193	129	167	135	152	199	144	150	108	113	125	158
Others	.....	.....	.....	7	.....	.....	.....	.....	.....	.....	1	2	3	5
Unexplained	377	296	385	243	102	136	186	259	238	310	237	192	175	223
Total derailments	1,004	759	1,032	705	641	681	681	926	741	857	597	557	481	709
ACCIDENTS WITHOUT COLLISION OR DERAILMENT:														
Boiler explosions	21	13	15	14	19	11	16	13	12	14	14	17	11	10
Cylinder explosions	6	3	7	2	2	.....	2	5	1	1	3	1	1	3
Broken parallel or connecting-rod	9	5	22	17	22	28	17	26	11	21	13	15	11	10
Cars burned while running	15	4	7	8	8	9	13	13	7	8	6	4	13	9
Various breakages of rolling stock	21	18	15	33	6	17	13	23	9	21	4	6	2	13
Other causes	29	18	33	12	12	7	4	4	2	.....	4	.....	1	6
Total without collision or derailment	101	61	99	86	69	72	65	84	42	65	44	43	39	51

RECAPITULATION.

Collisions	1,041	749	804	700	501	464	445	630	581	536	437	310	220	295
Derailments	1,004	759	1,032	705	641	681	681	926	741	857	597	557	481	709
Other accidents	101	61	99	86	69	72	65	84	42	65	44	43	39	61
Total	2,146	1 569	1,935	1,491	1,211	1,217	1,191	1,640	1,364	1,458	1,078	910	740	1,067

* Train mileage is taken from Poor's Manual, which gives *revenue* mileage only; that for 1890 is estimated.
† Average per year, five years, 1873 to 1877, inclusive.

It will be seen that the number of persons killed in 1890 is largely in excess of the number reported for the previous year; and the increase over 1888 and 1887 has fully kept pace with the increase in train mileage. So far as fatal injuries to employés are concerned it has, we think, been observable that the number of trainmen killed in each serious accident has shown a tendency to increase. The number of smaller accidents has increased along with the more serious ones, so that the average of casualties per accident cannot be relied upon to substantiate this view, but the theory that the increasing weight and speed of trains tends to make collisions and derailments (at least those on the open road) more disastrous has at least circumstantial justification here.

The number of passengers killed is 59 per cent. greater than in 1889. In that year the two most serious accidents, those at Johnstown, Pa., and Thaxtons, Va., were among the class which comes nearest to being unavoidable. In 1890 the three most notable cases were those at Shoemakersville, Pa., in September, Quincy, Mass., in August, and Oakland, Cal., in May, killing 22, 22 and 13 persons respectively. All of these were caused by negligence in operating. The first named was classed by us as a derailment from an unforeseen obstruction, but it will be remembered that this obstruction was clearly the result of negligence, so that the column showing the number of passengers killed by negligence in operating should really be increased from 115 to 139, bringing its total up to 80 per cent. of all the passengers killed in train accidents. The failure of a bridge at Kansas City in November killed 10 persons, but 9 of them were trespassers on the freight train that went down. A slight collision of freight cars at King's Mills, O., in July resulted in a powder explosion which killed eight persons outside the railroad premises. At Bayview, N. Y., in March occurred a passenger train collision from one of the most remarkable cases of negligence on record. The January report gives an instance of a bad passenger train collision under the block system, and some bad practice under automatic block signals is shown in the February account. So-called air-brake failures figured in two bad derailments in April, but both these cases turned out to be really attributable to negligence of trainmen. For other incidents connected with the accidents of the year which are worthy of special note the reader must be referred to our monthly records.

The classification of casualties according to the kind of accident in which they occurred is as follows:

KILLED.	Employés.	Passengers.	Other persons.	Total.
In collisions	302	74	37	413
In derailments	248	91	28	367
In other accidents	19	7	..	26
Total 1890	569	172	65	806
Total 1889	336	108	48	492
Total 1888	434	168	65	667
Total 1887	406	207	43	656

INJURED.	Employés.	Passengers.	Other persons.	Total.
In collisions	875	514	48	1,437
In derailments	603	672	16	1,291
In other accidents	41	38	5	84
Total 1890	1,519	1,224	69	2,812
Total 1889	978	745	49	1,772
Total 1888	1,098	1,012	94	2,204
Total 1887	890	916	140	1,946

The number of persons killed and injured in train accidents during the past 11 years, as tabulated in our accounts, was as follows:

	Killed.	Injured.
1890	806	2,812
1889	492	1,772
1888	667	2,204
1887	656	1,946
1886	416	1,409
1885	367	1,530
1884	389	1,760
1883	473	1,910
1882	380	1,588
1881	414	1,597
1880	315	1,172

The more prominent causes of collisions are shown in the following table:

CAUSES OF COLLISIONS.

	1890.	1889.	1888.	1887.	1886.	1885.
Train breaking in two	65	82	67	55	81	65
Misplaced switch	90	59	61	44	41	33
Failure to give or to observe signals	82	58	62	53	30	17
Mistake in giving or understanding orders	73	46	40	42	27	27
Miscellaneous	243	150	130	87	43	47
Total explained	553	395	360	281	222	189
Unexplained	488	354	444	419	279	275
Total	1,041	749	804	700	501	464

As has been heretofore announced, the number of accidents happening in the United States is now so large that we do not report the whole of them in full, though the tables and totals are made in the same manner as heretofore. That our accounts are, to a considerable extent, gathered from the newspapers, and are, therefore, far from perfect; that the "passengers injured" is an unsafe column in which to make comparisons, because of the different standards of reporting, and that for these and other reasons our totals and our deductions must be "handled with care," and used chiefly for comparison, we suppose is now well known to our readers.

In reference to the agreement for the apportionment of competitive traffic between the southwestern lines, of which much has been said in the papers of late, the exact facts are as follows: The agreement has not collapsed; no notice of withdrawal has been given by any line, and every line professes its intention and purpose of carrying it out. It has been said that none of the lines have complied with the last two orders for diversion made by the board. This is not true. On the contrary, one of the lines which have acted, the Chicago, Milwaukee & St. Paul, has fully carried out the "requests," and the Burlington is in process of doing so. In respect to the Atchison, a large number of cars have been diverted under

these orders, some of them as late as January 25, but its transfers have been slow and the delay has been so great that a circular was issued by Chairman Walker telling the other road that in the opinion of the Board the Atchison had failed to perform its obligations. The main reason given for these delays on the part of the Atchison was the small amount of tonnage moving at the present time, making it extremely difficult to find divertible or controllable traffic. The road also made a request to be heard in respect to certain mistakes claimed to have been discovered in the statistics upon which the Board was acting in making its awards. Mr. Walker and the other members of the Board held, however, that the agreement required that its performance should not be suspended for the purpose of such a hearing, and that divertible traffic could be found if sufficient effort was made. Mr. Manvel and other officials of the Atchison have been for some time on a trip to the Pacific coast, and nothing will probably be done till they get back.

The statistics which are telegraphed from Chicago from time to time in this matter are misleading, as they relate only to eastbound movement, in carloads, of traffic from Missouri River points, while the agreement includes all traffic moving in both directions upon a basis of gross revenue. Some of the roads having a light eastbound movement have a heavy westbound movement of more remunerative freight, and it is impossible to draw intelligent conclusions from the statistics which have been seized upon by the reporters. The statements also which have from time to time been published in respect to the percentages claimed by one and another line are inaccurate. There are eight lines between which the traffic is to be divided which if divided equally would give each line 12½ per cent. No one line has claimed anything like 40 per cent.

While this agreement has not been tried long enough to warrant definite predictions concerning its future, it must certainly be credited with some good results already. Those familiar with its working are confident that rates would not have been so soon and so completely restored without it; and there is now very little complaint of rate cutting in that territory, a state of things which experience warrants us in regarding as an improvement. An actual division of traffic has been carried out for months without encountering any legal obstacles or other outside hindrance, and it is greatly to be desired that so important an experiment shall not be allowed to fail of its object simply from lack of reasonableness and patience on the part of those who conduct the negotiations.

Judge Dundy, in rendering his decision in the Circuit Court at Omaha in the case of the Chicago, Milwaukee & St. Paul against the Union Pacific for an injunction restraining the Union Pacific from interfering with the use of the Omaha bridge and terminals by the St. Paul, and to enforce the contract executed between the two companies, makes the point that the execution of the contract is denied by the answer to the bill and that it is not established by proofs; also that it does not appear that any time tables have been agreed upon by the parties, and that in the absence of such time tables a preliminary injunction ought not to be granted. As to the power of the Union Pacific to make such a contract, or of the courts to specifically enforce the contract, he declines to give any decision yet. He holds that under the bridge charter the connecting lines have a right to use the bridge and approaches upon paying a reasonable compensation, which can be fixed by the court if the parties do not agree. The Chicago, Milwaukee & St. Paul is accordingly at work preparing additional proofs of the execution of the contract and other matters suggested by the opinion, which will be submitted to the court for final hearing probably at the May session. As will be seen, the opinion of Judge Dundy neither affirms nor denies the right of the St. Paul to use the bridge, although he apparently is of opinion that if the St. Paul succeeds in establishing the execution of the contract as alleged it will be entitled to the use of the bridge "upon paying a reasonable compensation." What decision may be rendered when the proofs are all submitted is purely a matter of conjecture at the present time. The Rock Island, which has a similar contract, has not as yet commenced any proceedings in the United States court, and very likely will await the decision in the St. Paul case, though it may proceed before some other tribunal.

The bold and comprehensive young man who makes railroad history for the daily press has outdone himself the last week. We have never seen anything more brilliant than the sweeping changes which he has made in railroad ownership in that time. We give a few of them, but have probably missed some of the most daring. Jay Gould has secured an option on the B. & O. He has also bought the Alton, and the Alton and the Mobile & Ohio are consolidated. The Richmond Terminal has bought the Monon. The Atchison has bought the Rio Grande Western. The B. & O. has bought the Western New York & Pennsylvania. Therefore, considering the well-known arrangement between Mr. Gould, Mr. Huntington and the Atchison, it will be seen that the most gigantic combination of railroads ever made is about to startle the world. Further, the D., L. & W., the D. & H. Canal Co. and the West Shore have severally bought the New York, Susquehanna & Western. The Great Northern has bought the "Kansas City." The Lake Erie & Western has euchred the Gould party by buying the Monon also; and the Norfolk & Western will bother them by getting control of the Western Maryland. The Rome, Watertown & Ogdensburg has been bought by the New York Central and the Ontario & Western. Finally, roads in the Northwest, aggregating about 30,000 miles, have all bought each other.

The Chicago Car Service Association handled 878,542 cars during the year 1890, and Manager E. D. Moore has just issued a statement showing by months the number of cars coming under the rules on each of the 25 roads in the association. The average detention was 1.57 days. For 1889 it was 1.76 days, the number of cars being a little less. Manager Moore has also issued a statement showing the collections and the amounts refunded on each road and the expenses of the association apportioned to the several companies. The total collections were $108,276. The amounts refunded aggregate $11,953, which is 10.7 per cent. of the collections. The expenses of the association were $22,017, which is 22.7 per cent. of the net collections. The roads collecting over $10,000 each were C., B. & Q.; C. & E. I.; C. & N. W.; C., M. & St. P., and the Chicago Railway Transfer Association, the latter being the concern that handles the cars at the Union Stock Yards. The amounts refunded by the four principal roads just named do not vary greatly from the general average (11 per cent.), but the amount refunded by the Transfer Association was only about one-tenth of one per cent. The percentage of collections refunded on the smaller roads varies greatly.

The Employés' Relief Association of the Philadelphia & Reading reports an increase of membership during the year to Nov. 30 of 1,500, and it is stated that *ninetgy-eiht per cent.* of all the employés of the company are members of the association, which would seem to indicate that membership is in some degree compulsory, a point which was considerably controverted in the newspapers during the earlier months of the association's existence. The total contributions to Nov. 30 last were $44,833; payments for deaths and disablements, $275,488.

NEW PUBLICATIONS.

The Theory and Practice of Surveying. By J. B. Johnson, C. E., Professor of Civil Engineering, Washington University, St. Louis, Mo., etc., etc. Seventh, revised and enlarged edition. New York: John Wiley & Sons. 1891; pages, 730, with numerous illustrations and an index. Price $4.

Professor Johnson's "Surveying" has been before the public for five years, and has become a standard and well-known work. The title page says that it is designed for use of surveyors and engineers generally, but especially for the use of students in engineering. But so long as surveyors and engineers generally continue to be students they will find use for this treatise. The seventh edition embodies a good many changes and additions. The chapter on land surveying has been entirely recast, and an appendix added giving the location of all the principal meridians and accompanying base lines which have been used in laying out the public lands. A method of running out parallels of latitude, with tables, has been added, and also a table for getting the azimuth by observation on polaris at any hour. This table is condensed from the tables issued in a "Manual of Instructions," by the Commissioner of the General Land Office in 1890.

Essays on Road Making and Maintenance and Road Laws. Philadelphia: Henry Carey Baird & Co. 1891. Price $2.

In 1889 a committee was appointed, through the University of Pennsylvania, to offer prizes for the best essays upon the construction and maintenance of common roads. The volume announced here contains the essays which received prices and honorable mention from that committee, together with a synopsis of other contributions, and a review by Prof. Lewis M. Haupt, and an introduction by William H. Rhawn, chairman of the committee. The essays which received the prizes were written by Henry Irwin, Assistant Engineer Canadian Pacific Railway; David H. Bergey, North Wales, Pa., and James Bradford Olcott, South Manchester, Conn. Five other essays received honorable mention.

The American Patent System. By D. Walter Brown, 31 Nassau street, New York.

Mr. Brown is a patent lawyer and has issued in this little handbook a reprint of a series of articles which he wrote for the *American Machinist.* There are eight chapters, telling in very clear and simple language those features of our American patent laws which an inventor or investor in patents most desires to know. The price of the book is 25 cents.

Trautwine's Civil Engineer's Pocket Book.—The author announces that, on receipt of request from persons owning copies of this work, the new and corrected article on Centrifugal Force, prepared for the 1891 edition, will be sent postpaid in the shape of a leaflet for insertion in the 10th (1886) and later editions in place of pages 365 to 370. Mr. Trautwine's address is 3301 Haverford street, Philadelphia.

New England Roadmasters' Association.—Secretary G. L. R. French, of Northampton, Mass., has issued the report of the eighth annual convention. The reports and discussions are printed in full and appear to have been edited with care. One of the advertisers has "got the bulge" on his competitors and secured the insertion of his page in the midst of the reading matter.

An Abstract of Patents on the Compound Locomotive.

I.

The following is a list of the most important English and United States patents relating to compound locomotives. The number of the patent, its date, the name of the inventor and the name of the particular detail to which the patent relates are given in the list. The Roman numerals refer to the description of the patent, which follows. This compendium will serve to acquaint one with the general condition of the art, and will show the types which have been patented in England and the United States:

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Starting valve	V.	*E.* 4,323	6	H. Percy Holt..	11-1876
	XII.	*E.* 15,699	1	A. J. Bickmore.	11-1884
	XII.	*E.* 15,699	2	" "	11-1884
	XIII.	*E.* 9,955	1	R. C. Parsons..	8-1886
	XIV.	*E.* 15,401	1	Wm. Hornsby; F. J. Cribb....	11-1886
	XV.	*E.* 910	1	R. H. Lapage...	1-1887
	XV.	*E.* 310	2	" "	1-1887
	XVIII.	*A.* 5,128	1	H. W. Adams..	11-1872
	XX.	*A.* 232,438	2	F. E. Beaumont	9-1880
	XXI.	*A.* 264,937	2	H. D. Dunbar...	9-1882
	XXII.	*A.* 270,167	4	F. W. Webb....	1-1883
	XXIII.	*A.* 276,378	1	H. D. Dunbar...	4-1883
	XXVII.	*A.* 361,471	1	A. Von Borries.	4-1887
	XXVIII.	*A.* 363,085	5	S. Robinson.....	5-1887
	XXIX.	*A.* 404,295	1	R. Lindner.....	5-1889
	XXX.	*A.* 405,570	2	R. H. Lapage...	6-1889
	XXXV.	430,969	1	Pitkin & Lane..	6-1890
	XXXV.	430,969	2	.....	.....
	XXXV.	430,969	3	.....	.....
	XXXV.	430,969	4	.....	.....

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Cylinders, arrangement of.....	I.	*E.* 11,473	1	Thos. Craddock	1846
	I.	*E.* 11,473	3	" "	1846
	I.	*E.* 11,473	15	" "	1846
	II.	*E.* 2,866	1	Jas. Sutcliffe..	12-1853
	III.	*E.* 1,904	1	Peter Salmon..	8-1859
	VI.	*E.* 1,110	2	Th Robertson, Jr.; Alex. Henderson.....	3-1877
	VIII.	*E* 3,079	1	Robt. Burton...	7-1880
	VIII.	*E.* 3,079	3	" "	7-1880
	X.	*E.* 299	2	Jas. Matthews..	1-1881
	XV.	*E.* 310	4	R. H. Lapage...	1-1887
	XV.	*E.* 310	5	" "	1-1887
	XVI.	*E.* 16,608	1	F. W. Webb....	11-1888
	XVII.	*A.* 70,341	1	John H. Lay...	10-1867
	XXI.	*A.* 264,937	1	H. D. Dunbar..	9-1882
	XXII.	*A.* 270,167	1	F. W. Webb	1-1883
	XXIV.	*A.* 345,009	1	I. Vernon.....	7-1886
	XXV.	*A.* 351,921	1	W. B. & J. A. Johnson.....	11-1886
	XXVIII.	*A.* 363,085	1	S. Robinson....	5-1887
	XXX.	*A.* 405,570	1	R. H. Lapage...	6-1889
	XXX.	*A.* 405,570	2	" "	6-1889
	XXXI.	406,011	1	S. M. Vauclain.	6-1889

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Steam chest...	XXIII.	*A.* 276,368	2	H. D. Dunbar...	4-1887
Valve seat....	XXIII.	*A.* 276,368	3	" "	4-1883
Condenser	IX.	*E.* 207	3	T. Robertson, Jr.	1-1881
	IX.	*E.* 207	4	" "	1-1881
	IX.	*E.* 207	5	" "	1-1881
Saddle	XXI.	*A.* 264,937	3	H. D. Dunbar...	9-1882
Truck.....	XXIV.	*A.* 345,009	3	I. Vernon.....	7-1886

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Valves, arrangement of	I.	*E.* 11,473	15	Thos. Craddock	1846
	VII.	*E.* 929	1	David Joy.....	3-1879
	VIII.	*E.* 3,079	2	Robt. Burton...	7-1880
	XVIII.	*A.* 5,128	2	H. W. Adams..	11-1872
	XIX.	*A.* 189,704	1	A. W. Cumming	4-1877
	XX.	*A.* 232,438	1	F. E. B. Beaumont.....	9-1880
	XX.	*A.* 232,438	3	F. E. B. Beaumont.....	9-1880
	XX.	*A.* 232,438	4	F. E. B. Beaumont.....	9-1880
	XXIII.	*A.* 276,368	1	H. D. Dunbar..	4-1883
	XXVIII.	*A.* 363,085	6	S. Robinson....	5-1887
	XXVIII.	*A.* 363,085	9	S. Robinson....	5-1887
	XXVIII.	*A.* 363,085	10	S. Robinson....	5-1887
	XXXI.	*A.* 406,011	2	S. M. Vauclain.	6-1889
	XXXII.	*A.* 406,012	1	S. M. Vauclain.	6-1889
	XXXII.	*A.* 406,012	2	S. M. Vauclain.	6-1889

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Arrangement of parts.....	IV.	*E.* 4,123	18	Al. Pullan.....	10-1876
	VI.	*E.* 1,110	1	Th. Robertson, Jr.; Alex. Henderson.....	3-1877
	XVI.	*E.* 16,608	2	F. W. Webb....	11-1888
	XXV.	*A.* 351,921	2	W. B. & J. A. Johnson.....	11-1886
	XXVI.	*A.* 360,834	1	T. W. Worsdell.	4-1887
	XXVII.	*A.* 361,471	1	A. Von Borries.	4-1887
	XXVIII.	*A.* 363,085	2	S. Robinson.....	5-1887
	XXVIII.	*A.* 363,085	3	"	5-1887
	XXVIII.	*A.* 363,085	4	"	5-1887
	XXVIII.	*A.* 363,085	8	"	5-1887
	XXX.	*A.* 408,570	3	R. H. Lapage...	6-1889
	XXX.	*A.* 408,570	4	"	6-1889
	XXXIII.	*A.* 409,936	4	J. Des Brisay...	8-1889
	XXXIII.	*A.* 409,936	5	" "	8-1889
	XXXIII.	*A.* 409,936	6	" "	8-1889
	XXXIII.	*A.* 409,936	7	" "	8-1889
	XXXIII.	*A.* 409,936	8	" "	8-1889
	XXXIV.	*A.* 428,892	1	H. F. Colvin....	5-1890
	XXXIV.	*A.* 428,892	2	"	5-1890
	XXXIV.	*A.* 428,892	3	"	5-1890

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Valves, rotary.....	XXXIII.	*A.* 409,936	1	J. Des Brisay...	8-1889
	XXXIII.	*A.* 409,936	2	"	8-1889
	XXXIII	*A.* 409,936	3	"	8-1889
Engines, rotary.....	X.	*E.* 299	1	Jas. Matthews.	1-1881
Engines, oscillating...	I.	*E.* 11,473	11	Th. Craddock..	1846

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Exhaust, arrangement of	IX.	*E.* 207	1	T. Robertson, Jr.	1-1881
	IX.	*E.* 207	2	"	1-1881
	XVIII.	*A.* 5,128	3	H. W. Adams.	11-1872
	XVIII.	*A.* 5,128	4	"	11-1872
	XXII.	*A.* 270,167	3	F. W. Webb...	1-1883
Drivers.....	XVI.	*E.* 16,608	3	"	11-1888
	XXII.	*A* 270,167	2	"	1-1883
	XXII.	*A.* 270,167	5	"	1-1883

Subject.	No.	Patent.	Claim.	Patentee.	Issued.
Reverse lever.	V.	*E.* 4,323	7	H. P. Holt.....	11-1876
Pistons..	X.	*E.* 299	3	Jas. Matthews..	1-1881
Connecting rods	XIX.	*A.* 189,704	2	A. M. Camming	4-1877
Guides..	IV.	*E.* 4 123	1	Abm. Pullan. ...	10-1876
Rockers..	XIX.	*A.* 189,704	3	A. M. Camming	4-1877
	XIX.	*A.* 189,704	4	" "	4-1877

I.—English Pat. No. 11,473. *Dated* 1846. *Inventor, Thomas Craddock.* Claim: I claim the double cylinder, high-pressure expansion and condensing steam engine, with its various appendages, described under the first head of this specification in the general combination and arrangement of parts of which the same consists, whereby high pressure steam is worked expansively, in conjunction with a vacuum and the condensation of the exhaust steam, by the external application of the atmosphere to the condenser, and the retention of the water of condensation and other advantages are secured; that is to say, in so far as regards the angular set given to the double cylinders and the connecting of them to one crank pin, the boiler and furnace, the damper or steam supply regulating apparatus, the steam chest, the condenser (which may be cooled by water in some cases instead of the atmosphere, the air pump and the steam valves.

3. I claim, in relation to all that class of high pressure engines in which steam of a high pressure is used in one small cylinder and then expanded into a second and larger cylinder, the setting of the cylinders at an angle and connecting them to one crank pin, as before described, whether combined or not combined with any other improvements, all or any of them, and in whatever position the said cylinders may be fixed in other respects, as horizontally, vertically or obliquely.

II.—English Pat. No. 2866. *Dated Dec.* 9, 1853. *Inventor, James Sutcliffe.* Claim: Firstly, as applied to the engine mentioned, causing the piston of the low-pressure or expansion cylinder to perform a greater number of strokes in a given time than that of the high-pressure cylinder.

NOTE: In this design the high-pressure cylinder drives an auxiliary shaft which by means of gears drives the axle of the driving wheel.

III.—Pat. No. 1904. *Dated Aug.* 19, 1859. *Inventor, Peter Salmon.* Claim: A mode of arranging and combining the high-pressure cylinder or cylinders, and the expansion cylinder or cylinders and the heating chamber for the feed water.

IV.—English Pat. No. 4,123. *Dated Oct.* 24, 1876. *Inventors, Abraham Pullan, George Robbington and Thomas William Pullan.* Improvements relating to guide bars on locomotives, compound or three cylinder, or other engines and pumps. The construction of the high and low pressure trunk engine.

V.—Pat. No. 4,323. *Dated Nov.* 8, 1876. *Inventor, Henry Percy Holt.* Claim: A combined arrangement for admitting high or low pressure steam to the low-pressure cylinder, exhausting from high-pressure cylinder and a reversing lever arrangement for compound train engines.

VI.—Pat. No. 1,110, *Dated March* 20, 1877. *Inventors, Thomas Robertson, Jr., and Alexander Henderson.* Claims: The general construction or improved arrangement or combination of the parts of steam tramway cars or carriages, for giving the differential, compound and high-pressure powers and other advantages. The fitting and propelling of steam tramway cars with two or three cylinders and their fittings and hand gearing arranged to work compound or high-pressure direct in each and all the cylinders.

VII.—Pat. No. 929. *Dated March* 8, 1879. *Inventor, David Joy.* Claim: I do not claim making compound engines with their cylinders placed side by side and their pistons coupled to one cross head, but I claim the use of my improved arrangement of parts forming a connecting frame by means of which a proper distribution of strain is effected.

VIII.—Pat. No. 3,079. *Dated July* 26, 1880. *Inventor, Robert Burton.* Claim: 1. Compounding such engines by substituting for the single cylinder two concentric cylinders made to occupy its place, connecting the several piston rods with a cross head and transmitting the motion by the ordinary connecting rod to the crank upon the crank shaft of the engine.

2. The valve gear by means of which from the usual eccentrics both the slide valves have motion imparted to them.

3. The compound cylinders with their passages and arrangements.

IX.—Pat. No. 207. *Dated Jan.* 15, 1881. *Inventor, Thos. Robertson, Jr.* Claim: 1. The improvement in engines for tram cars or for analogous purposes, consisting of a high and low pressure or expansion cylinder or cylinders in combination with means for injecting (when additional power is needed) live steam into, before, or in front of the pipe or passage through which the steam is exhausted from the high-pressure cylinder to the low-pressure cylinder, or to the first low-pressure cylinder, where more than one is used through such a contracted passage or orifice or orifices as to create a vacuum or partial vacuum in the said pipe or passage, and on the exhaust side of the piston of the high pressure cylinder, the said live steam supplementing the power of the exhaust steam in the low-pressure cylinder.

2. In compound engines, providing at the end of the exhaust steam pipe or passage from the high-pressure cylinder to the low pressure cylinder at the end of the said pipe or passage which opens into the valve casing of the low-pressure cylinder, an injector consisting of a cone-shaped or inclined orifice around the said end of the said pipe or passage for injecting live steam thereabound and in front thereof in a conical stream, whether there be used or not in combination with the said injector a valve.

3. For condensing the exhaust steam of the engines of steam tramway cars or analogous engines, the combination with the exhaust pipe or passage of a surrounding casing or casings and perforations in the exhaust pipe or its continuation, and the means for admitting air to, or forcing air into, the said casing or casings, and therefrom into the exhaust pipe or passage.

X—Pat. No. 299. *Dated Jan.* 22, 1881. *Inventor, James Matthews.* Claim: 1. The general combination of parts forming my improved rotary steam, air, or gas engine, in which a piston, such as works in an annular chamber, the central part of the cylinder being filled by a boss, the abutment being formed by a hinged flap or shutter swinging in a plane transversely to the direction of motion of the piston, and operated partly or wholly by the piston itself or from the engine shaft.

2. The cylinder made in two halves, and having an annular piston chamber and a lateral extension for a hinged abutment flap.

3. The application in my improved rotary engine of two pistons in one cylinder or casing, and also in the combination of cylinders on the compound principle. Pat. No. 207: Its continuation to condense the exhaust steam.

4. The inclined or cone shaped orifice around the end of the casing or around the exit end or nozzle or termination of the exhaust pipe of the low-pressure cylinder (where it enters the condensing tank or receiving vessel) for injecting air in a conical stream into or in front of the said exhaust pipe, termination or nozzle.

5. The condensing nozzle for the exhaust steam from the low-pressure cylinder, consisting of an air casing and perforated pipe or nozzle for admitting or injecting air into and around the said pipe or nozzle in combination with the deflecting cones or funnels, there being a hole or its equivalent (provided or not with an air inlet valve) for giving communication between the outside of the nozzle and inside of the same above the water space of the condenser.

XI.—Pat. No. 1,128. *Dated March* 16, 1881. *Inventor, Francis William Webb.* This is an English patent same as No. XXII.

XII.—Pat. No. 15,699. *Dated Nov.* 28, 1884. *Inventor, Alfred James Bickmore.* Claim: 1. The interposition in compound locomotives of a stop valve between the large cylinder and the receiver, by which arrangement on the starting of the locomotive the entrance of the steam from the slide box of the large cylinder into the receiver is stopped, so that the small piston receives no back pressure.

2. The combination of the valve with a second valve in such way that by opening the first the second will be closed, and thus the direct admission of the steam to the large cylinder be stopped.

XIII.—Pat. No. 9,955. *Dated Aug.* 3, 1886. *Inventor, Richard C. Parsons.* Claim: In a compound locomotive or tram way engine the use in connection with the exhaust passage leading from the high-pressure to the low-pressure cylinder, of a valve so arranged in combination with a piston, that on admitting fluid pressure behind the piston the valve is moved so as to cut off the communication between the high and low pressure cylinders and establish a communication between the high-pressure cylinder and a passage leading to the atmosphere.

XIV.—Pat. No. 15,401. *Dated Nov.* 25, 1886. *Inventors, William Hornsby and Frederick James Cribb.* Claim: In compound traction, locomotive or portable steam engines the use of a stopping and starting valve formed of a sliding valve formed with a port and arched recess and capable of being slid over a valve face having four ports in it leading to the high and low pressure cylinders and the exhaust as described so as in one position to admit steam to both high and low-pressure cylinders and provide a direct exhaust from the high-pressure cylinder—in another position to cause the engine to work compound and in a third position to shut off steam from both cylinders.

XV.—Pat. No. 310. *Dated Jan.* 8, 1887. *Inventor, Richard H. Lapage.* Claim: 1. In a compound locomotive engine providing in a passage between the high and low pressure cylinders combined or connected, starting and intercepting valves substantially such as hereinabove described, arranged to operate in an automatic manner, as set forth, so that when steam is admitted to the steam chest of the high-pressure cylinder by the regulator for starting, the starting valve will be in, or will be caused by pressure of steam from the regulator to assume, a position such that high-pressure steam will be admitted to the low-pressure cylinder, and the intercepting valve will be in, or will be caused by the said steam pressure to assume, a position in which it will close communication between the high and low pressure cylinders.

2. In a compound locomotive engine the construction and arrangement of a pipe or casing with a cylinder, steam inlet and exhaust passage combined, or connected starting and intercepting valves and exhaust valve.

3. In a compound locomotive engine the combination with a high-pressure exhaust valve of an auxiliary steam supply valve, for admitting high pressure steam for use in the low-pressure cylinder, and a connection between the said valves such that when the exhaust valve is opened and closed the auxiliary steam supply valve will be also opened and closed.

4. In a compound locomotive engine the arrangement substantially as hereinabove described of the low-pressure cylinder or cylinders on a bogie or swiveling frame or truck in connection with a steam passage through a swivel or sliding joint.

5. A compound or combined locomotive comprising a locomotive proper with high-pressure cylinder or cylinders and a tender or vehicle carrying the low-pressure cylinder or cylinders, the latter cylinder or cylinders being connected to the high-pressure cylinder or cylinders by a pipe or pipes provided with a steam joint or joints that will admit of movement or play of the said tender or vehicle in relation to the locomotive proper.

XVI.—Pat. No. 16,608. *Dated Nov.* 15, 1888. *Inventor, Francis W. Webb.* Claim: In locomotive engines the combination and arrangement of two sets of cylinders together so that both sets of cylinders may be worked by steam direct from the boiler, or one set of cylinders by steam direct from the boiler, and the other cylinder or set of cylinders by exhaust steam from the set of cyliaders worked by steam direct from the boiler.

In locomotive engines with two sets of cylinders combined, arranged and worked as hereinbefore described, the coupling of the wheels driven by one set of cylinders with the wheels driven by the other cylinder or set of cylinders.

THE SCRAP HEAP.

Notes.

The shops of the New York, Lake Erie & Western, at Susquehanna, on Saturday last began running on eight hours' time. Reductions of time and of forces have been made at other shops of the company.

The bridge of the Belt Railroad spanning Pigeon Creek at Evansville, Ind., fell Feb. 5 while a freight train was passing over it. A span 100 feet in length and a new furniture car were badly wrecked. The engine did not go down.

Governor Boyd's message to the Nebraska legislature is conservative in regard to railroads. He recommends the establishment of the maximum freight rates only on coarse freight, such as grain, coal, etc. He recommends leaving passenger fares at the present figures.

The Denver & Rio Grande has in use a system of manifesting perishable freight under which the numbers of the cars in a train are all put on one manifest, and the conductor at the end of each run telegraphs to the car accountant that all the cars on the manifest have arrived at a certain point. If any car is short it is so reported, and is traced by telegraph at once.

Passenger train No. 17, of the Southern Pacific, was boarded by robbers at Alila, Cal., on the evening of Feb. 6, and under cover of pistols the engineer was forced to pull out a mile and halt. The engineer and fireman were taken back to the express car. The messenger saw what was up and blew out his lights, and instead of opening the door commenced firing at the robbers. The robbers were beaten off, but the fireman was killed in the fight.

The "joint legislative board," said to represent the Brotherhood of Locomotive Engineers, Brotherhood of Railway Conductors, Brotherhood of Railroad Trainmen, Switchmen's Association of America and the Order of Railway Conductors on the railroads in the state of of Kansas, appeared lately before the legislature and presented a protest against the passage of the maximum rate bill, which proposes to establish in Kansas the same freight rates as are now in operation in Iowa.

Foreign Notes.

According to a Zanzibar account preliminary work is shortly to be commenced on a railroad from Bagamoyo to Dar-es-Salaam.

According to the *Elektrotechnische Zeitschrift* the royal railroad commission at Berlin, Germany, has finally concluded to institute trials with electric lighting for railroad trains. Two test cars have been equipped with incandescent lamps for the purpose. The current is supplied from storage batteries under the cars.

Application has been made to the Hungarian Minister of Commerce for a franchise for an electric railroad from Budapest to Vienna. The cost of construction is placed at 59,000,000 florins. The road, it is stated, is to be used exclusively for passenger traffic. A car is to be dispatched from each end of the line at intervals of 10 minutes, and the trip from one end to the other is to be made in two and a half hours.

The Government and the Pacific Railroads.

A Washington dispatch states that action is about to be taken by the Government under the recent decision of the Supreme Court of the United States reversing a decision of the Court of Claims, in which it was held that, in the process of ascertaining the net earnings of the Union and Central Pacific, upon which 25 per cent. is required to be paid to the Government under the Thurman act, it was proper to deduct from the gross earnings not only the actual operating expenses, necessary repairs, and interest on the first mortgage bonds, but also that there should be deducted all sums paid for improvements, betterments, and new equipments.

The Supreme Court had held, before the passage of the Thurman act, that it was proper to make deductions for new construction and equipment, but now holds that, under the Thurman act, the net earnings must be ascertained by deducting from the gross earnings only the actual operating expenses, necessary repairs made within the year, and interest on the first mortgage bonds.

Under this method of calculation the net earnings of the Central Pacific will be increased over $2,000,000 and the net earnings of the Union Pacific nearly $7,000,000 since the passage of the Thurman act, 25 per cent. of which sums is now recoverable by the government.

German Rails for Brazil.

Kuhlow's states that the Dortmund Union has contracted to deliver rails weighing 20 kilograms per metre, with fittings, for a railroad from Rio de Janeiro to the interior, for 140 marks per metric ton free at Rio, for about $33.11 per ton of 2,240 lbs. The expenses of this transaction are placed by *Kuhlow's* as follows, viz.: Freight to Antwerp, 6.50 marks per ton, and sea freight with insurance, etc., 34 to 35 marks, leaving a scant 100 marks for the Dortmund Union. The deliveries are to be made during six years. The number of tons is not given.

The Chicago & Erie Strike.

One explanation of the fact that the road was allowed to be completely tied up is that the state laws of Indiana offer absolutely no protection to railroads in such a trouble. The strikers at Huntington cut the bell cords, pulled coupling pins and committed other acts of violence to prevent the movement of trains. The mayor of the city, the sheriff of the county and even the state officials were appealed to, but they all refused to interfere, saying that the laws gave them no authority to act in such a case. Without protection it was useless for the company to attempt to move trains. On the day that the strike was inaugurated the conductors did not refuse to take charge of their trains at Chicago, but ran five loaded passenger trains to Huntington and there abandoned them.—*Exchange.*

LOCOMOTIVE BUILDING.

The Grant Locomotive Works is preparing to begin the construction of its works at Chicago in the spring. Plans are now made for complete shops with an annual capacity of 250 locomotives. The plans are so designed that extensions can be made as required at a minimum expense. The shops will be built and equipped with a view to rapid and economical production, although they will not have as many special tools as are to be found in the new Juniata Shops of the Pennsylvania Railroad. The recent decisions of the courts have vested in the company the title to the land which it occupies and no further troublesome litigation is anticipated. The company is advertising for sale a considerable part of its property, divided up into building sites.

CAR BUILDING.

The Western New York & Pennsylvania let part of its car contract this week, and the Peninsular Car Co. is reported to have been awarded 500 of the gondola cars.

The Buffalo, Rochester & Pittsburgh, the Mahoning Valley, and the Lehigh & Hudson River roads are each in the market for new freight cars.

The Pullman Car Co. is building a large number of passenger cars for the Chicago & Northwestern; and also fifty new sleeping and parlor cars for the Pullman lines; a number of these cars are for the Pennsylvania routes.

The Chicago & Alton has just put upon its Chicago-St. Louis night trains two magnificient Pullman compartment cars, named "Majestic" and "Teutonic." The cars are each 70 ft. long, containing 6 sections, 4 compartments, enclosed smoking-room, toilet rooms and drawing-room. Each compartment is fitted with toilet accessories, hot and cold water. The cars are lighted by the Pintsch system, and cost $40,000. The panelling and upholstering are especially elegant.

It is probable that the Baltimore & Ohio order for from 500 to 1,000 cars will be ready to give out this month.

The Great Northern has placed contracts with the Haskell & Barker Car Co., of Michigan City, Ind., for several hundred furniture cars.

The Ohio Falls Car Co., Jeffersonville, Ind., has closed a contract to build 200 freight cars for the Nashville, Chattanooga & St. Louis.

One thousand box cars of 60,000 lbs. capacity are being constructed for the Central States Despatch, the new Baltimore & Ohio and "Big Four" fast freight line.

BRIDGE BUILDING.

Baltimore, Md.—Plans are being prepared for an iron bridge over North Avenue, Baltimore, which will probably be erected if the cost to the city does not exceed $228,000.

Caldwell County, Tex.—Five iron bridges costing about $7,000 are to be built by the Board of County Commissioners, whose office is at Lockhart.

Cincinnati, O.—The Board of City Affairs has passed a resolution to construct a viaduct on West Eighth street, at an estimated cost of $312,057. This viaduct will have a total length of 3,062.48 ft., including approaches.

Dahlonega, Ga.—A bridge is to be built across the Chestatee River. F. M. Williams can give information.

Indianapolis, Ind.—The City Civil Engineer is working on plans and specifications for the Virginia avenue viaduct. The structure will be 1,300 ft. long.

Max Meadows, Va.—It is stated that H. C. Baker, Manager of the Max Meadows Land & Improvement Co., has recently terminated negotiations for establishing an iron bridge works plant in that place.

New York-Brooklyn.—Senator Birkett, of Brooklyn, introduced in the New York State Senate last Tuesday a bill providing for two bridges from Brooklyn to New York City; one of them to begin in Brooklyn at Broadway and Marcy avenue, near the Grand Street Ferry, and the other to begin between Fulton street, Brooklyn, and Little and Bridge streets; both to reach Manhattan Island somewhere south of Rivingston street and north of Cherry street. Both of the bridges will be above the present suspension bridge.

The Assembly Committee on Commerce and Navigation on the same day agreed to report favorably the Ranney Bridge Bill, providing for a bridge over the East River, near the south end of Blackwell's Island, to Long Island City.

Ocean Springs, Miss.—A bridge is to be built across the Fort Bayou.

Ottawa, Can.—It is understood that the work of construction will shortly be commenced on the long railroad bridge which is to connect the provinces of Quebec and Ontario at Ottawa. The Canada Atlantic, Pontiac & Pacific Junction, Ottawa & Gatineau Valley, Vaudreuil & Ottawa, and the Ottawa, Morrisburg & New York are all said to be interested in the success of the bridge.

Roanoke, Va.—Work on the overhead bridges is progressing rapidly. The iron work is being erected by the American Bridge Works, of Roanoke.

St. Louis.—The Board of Public Improvements has let contracts for the following bridge work: Erecting the steel work of the superstructure of the Twenty-first street bridge complete in position, 2,600,000 lbs., 4.8 cents per lb., Youngstown Bridge Co.; erecting the steel work of the Weber Road bridge, over Gravois Creek, the sum of $975, Chicago Bridge & Iron Co.; erecting the steel work and railing of the Knox avenue bridge over Rivier des Peres, the sum of $2,493, Massillon Bridge Co.

Winston, N. C.—A contract has been let by the Winston Salem Land & Improvement Co. to Dean & Westbrook, of New York City, for the construction of an iron bridge.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In Illinois the Supreme Court rules that a railroad which allows another road to run trains over its tracks is jointly liable with the latter for injuries caused by its negligence.[1]

A railroad, it is held by the Supreme Court of Nebraska, may impose reasonable conditions upon persons who erect, or who are about to erect, elevators at stations on the line of such roads, but such conditions and terms must be the same to all such persons. The court also rules that under the statute forbidding any discrimination in receiving and forwarding freight, and giving the Board of Transportation authority to investigate any alleged violations of such act, and make necessary orders, and enforce them, the Board of Transportation may institute an action, in a proper case, to require a road to furnish like facilities to erect an elevator at one of its stations to any person engaged, or who desires in good faith to engage in the business of receiving, handling and shipping grain over the railroad.[2]

A Mississippi statute provides that the railroad commissioners are authorized to designate the site of any new depot, and to prescribe the number and dimensions of the rooms therein, and provides for a penalty of $50 per day against a railroad neglecting to comply with such order. The Supreme Court rules that the penalty cannot be enforced where a new depot was ordered to be built, but the number of rooms was not prescribed.[3]

The Supreme Court of the United States holds that a contract between two railroad companies in relation to the carriage of freights and division of earnings, which provides that this "contract, and any damages for the breach of the same, shall be a continuing lien upon the roads of the two contracting companies, their equipment and income, in whosesoever hands they may come," does not constitute a lien or obligation running with the land, so as to render it liable in the hands of a purchaser of one of the roads for supposed earnings that would have accrued during the term provided in the lease.[4]

A Georgia statute provides that the railroad therein named, if its route is located within five miles of the town of T., shall run into such town, provided that the excess of the cost of the route through T. over the route proposed by the company shall be paid "by the town of T. or the citizens thereof." The Supreme Court holds that the requisite amount is to be raised voluntarily by the people of the town, and not furnished by the corporation out of the public revenue.[5]

In Illinois the Supreme Court decides that railroads being intended for the benefit of the public, the right of a railroad company to change the location of its station so as to accommodate the public better cannot be restrained by a contract between the company and the inhabitants of a village that a station shall be maintained at such village.[6]

The Supreme Court of Nebraska rules that the statute of 1887 which requires all railroads to make and keep in repair sufficient crossings on highways established across their road after it is built, though it imposes a burden on such companies that did not exist when they were incorporated, is a valid exercise of the police power of the state, and it applies as well to highways established after the construction of the railroad as to those in existence when it was built.[7]

The Supreme Court of Illinois holds that where a town is authorized to subscribe for railroad stock, and to issue bonds in payment therefor, the fact that such bonds are issued upon condition that the road should build its shops in that town does not invalidate the bonds, since the imposing of such condition does not change the object for which the bonds were issued.[8]

In Michigan the Supreme Court decides that under a statute providing that, where the commissioner of railroads directs a bridge "to be erected and maintained where one railroad crosses or intersects another, the expense thereof shall be borne jointly, in equal proportions, by the companies owning or controlling each of said roads," the crossing board may require a railroad company which desires to cross a street at a point occupied by another railroad to carry its tracks above those of the other company, and to provide a passage-way on its superstructure for teams and pedestrians, the cost of such passage-way to be borne by the two companies equally.[9]

The Court of Appeals of Kentucky rules that authority given to a railroad to lay its tracks and switches in a public street does not carry the right to use such street as a place for making up trains, nor as a depot for cars, nor for receiving or discharging freight.[10]

Injuries to Passengers, Employes and Strangers.

In Massachusetts the plaintiff took his seat in the smoking compartment of the baggage car; he did not notice that the train had started until it was fairly under way, and then, from his knowledge of the time of running the trains, knew there was serious danger of a collision. He went into the baggage car and stood at the door, ready to jump should there be danger of a collision, and did jump just before the trains collided. He knew that the rear end of the train was the safest. The Supreme Judicial Court of Massachusetts holds that he was not negligent.[11]

In Georgia the Supreme Court holds that one who takes passage on a freight train rather than wait a few hours for a passenger train, and is injured by a jolt caused by coupling cars, cannot recover, where the jolt was not caused by the negligence of the company's servants, but was usual and necessary in coupling the cars.[12]

In Illinois the Supreme Court rules that the omission to provide a flagman at a crossing, and to ring the engine bell when approaching it, do not constitute negligence, as against a person who is walking along the track, since such precautions are for the sole benefit of those about to cross the track.[13]

In Tennessee the Supreme Court decides that under the state statute which declares that in every case of non-observance by a railroad company of certain precautions to prevent accidents the company shall be liable for damages caused thereby, the fact that the injured person was guilty of contributory negligence, though admissible in mitigation of damages, is no bar to the action.[14]

In New York while attempting to drive across defendant's track at a street crossing, plaintiff was struck by a train going south, the approach of which was obscured by a train going north. Plaintiff had been waiting to cross while north-bound train was passing, and, seeing the gate go up, attempted to cross, but was shut in upon the track by the lowering of the gate on the opposite side. The Supreme Court holds the railroad liable, because the raising of the gate was an invitation to the plaintiff to cross and an assurance of safety.[15]

In Georgia the plaintiff was a switchman. While it was not his duty to give signals to the engineer to pass or stop at a station, it was customary for the conductor to direct him so to do when, from the nature of the road, his own signals could not be seen. The rules of defendant required the engineer to answer signals with the whistle, thus permitting the persons giving them to guard against the jerk caused by a sudden change of speed. Plaintiff, knowing the train was to pass the town it was approaching, gave the necessary signal without a previous direction from the conductor. Without answering it, the engineer put on steam, and a sudden jerk threw plaintiff from the car upon a trestle. Contrary to custom, the engineer increased the speed of the train before reaching the end of the trestle. The car was unprovided with the usual irons to hang on by. The Supreme Court reverses a judgment in favor of the company.[16]

In the Federal Court it is held that a telegraph operator employed by a railroad company to give information in regard to the location of trains on the road, and to communicate to the men on the trains instructions for running them, received by him from the train dispatcher, is a fellow-servant of the firemen on such trains.[17]

In the same court it is ruled that an engineer in charge of the engine on which plaintiff was fireman is not a fellow-servant of plaintiff.[18]

In New York it is held that a charge to the jury in an action by a passenger on an elevated railroad who, while leaving the car, was thrown down by other passengers entering, that, if defendant opened the gate to the platform of the car without giving any warning to let plaintiff alight first, it was an invitation to passengers on the station platform to enter the car, and to plaintiff to leave, and that if the platform was so narrow that two persons could not pass abreast, and that the passengers entering the car collided with plaintiff while leaving it in consequence of an invitation given by opening the gate, then defendant is liable for any injury to plaintiff caused by the collision without his fault, is objectionable as involving the conclusion that opening the gate of the car platform was an invitation to passengers to enter the car, rather than to plaintiff to alight, and also as making defendant liable for the negligence of one passenger to another, without negligence on its part.[19]

In New York the Supreme Court rules that the falling of an iron plate from an elevated railroad upon a person riding under the structure raises a presumption of negligence.[20]

In New York the Court of Appeals decides that the plaintiff, who was injured at a railroad crossing, being on the seat with the driver, and having the same knowledge of the road, and opportunities of discovering danger, the rule that the driver's negligence may not be imputed to the traveler had no application.[21]

In Michigan the plaintiff drove to a crossing with his back to an approaching train. Intervening objects obscured the view of the track so that he could not see the train until within a few feet of the crossing, and then only when it was a short distance from the crossing. A mill in the vicinity made considerable noise, and the wind was blowing in a direction to take the sound of a whistle from plaintiff. On reaching the crossing, the team hesitated, but plaintiff urged them across, and was struck by the train. He was thoroughly familiar with the crossing, and knew that the train was due. The Supreme Court holds that it was not sufficient that plaintiff looked and listened for the train as he drove along, but he should have stopped his wagon and listened.[22]

In Missouri it is ruled that in an action for injury at a railroad crossing, it was not error to instruct the jury that if they believed that the night was dark, and that the engine was running 25 miles an hour through a thickly settled portion of the country, without the headlight being lighted, in consequence of which the collision occasioning the injury occurred, they should find for plaintiff.[23]

In Louisiana the deceased was driving a team in an open field along a road that crossed a railroad track; when he approached the crossing he looked straight ahead, and did not stop, and so was struck by a passing train. On either side of the crossing the view of the track was unobstructed for half a mile; persons heard the train at that distance from the railroad, and the engineer, on discovering that deceased was dangerously near the crossing, blew the whistle and rang the bell. The Spreme Court rules that deceased was guilty of contributory negligence that would defeat a recovery, though defendant's servants were negligent in not blowing the whistle a quarter of a mile from the crossing, as required by the company's rules.[24]

[1] Penn. Co. v. Ellett, 24 N. E. Rep., 559.
[2] State v. M. P. Ry. Co., 45 N. W. Rep., 785.
[3] State v. Alabama & V. R. Co., 7 South. Rep., 562.
[4] D. M. & Ft. D. R. Co. v. W. St. L. & P. R. Co., 10 S. C. Rep., 753.
[5] Macon & B. R. Co. v. Stamps, 11 S. E. Rep., 442.
[6] Mobile & Ohio R. Co. v. People, 24 N. E. Rep., 642.
[7] State v. C., B. & Q. R. Co., 45 N. W. Rep., 469.
[8] Casey v. People, 24 N. E. Rep., 570.
[9] Fort Street Union Depot Co. v. State Railroad Crossing Board, 45 N. W. Rep., 973.
[10] Owensborough & N. R. Co. v. Sutton, 13 S. W. Rep., 1086.
[11] Cody v. N. Y. & N. E. R. Co., 24 N. E. Rep., 402.
[12] Crine v. E. T., V. & G. Ry. Co., 11 S. E. Rep., 555.
[13] Roden v. C. & G. T. R. Co., 24 N. E. Rep., 425.
[14] O. & S. W. R. Co. v. Foster, 13 S. W. Rep., 694.
[15] Kane v. N. Y., N. H. & H. R. Co., 9 N. Y. (Supt.), 879.
[16] Hudson v. Geo. Pac. R. Co., 11 S. E. Rep., 605.
[17] McKaig v. Nor. Pac. R. Co., 42 Fed. Rep., 288.
[18] Ragsdale v. Nor. Pac. R. Co., 42 Fed. Rep., 383.
[19] Buck v. Manhattan Ry. Co., 10 N. Y. Supp., 107.
[20] Volkmar v. Man. R. Co., 9 N. Y. Supp., 708.
[21] Brickell v. New York Cent. & H. R. R. Co., 24 N. E. Rep., 449.
[22] Brady v. Toledo, Ann Arbor & N. M. R. Co., 45 N. W. Rep., 1,110.
[23] Becke v. Missouri Pac. Ry. Co., 13 S. W. Rep., 1053.
[24] Brown v. Texas & P. Ry. Co. (La.), 7 South Rep., 682.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Alton, quarterly, $2 per share, on the common and preferred stock, payable March 2.

Flint & Pere Marquette, semi-annual, 2 per cent., payable Feb. 16.

St. Paul & Duluth, 2½ per cent. on the preferred stock, payable March 2.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Camden & Atlantic, annual, Cooper Point, Camden, N. J., Feb. 26.

Chicago Belt, special, Chicago, Ill., Feb. 24, for the purpose of making a new lease with the Chicago & Western Indiana.

Chicago & Western Indiana, special, Chicago, Ill., Feb. 24, to consider proposed improvements.

Chippewa Valley, annual, Mount Pleasant, Mich., Feb. 18.

Cleveland & Canton, special, Canton, O., Feb. 25.

Delaware, Lackawanna & Western, annual, 26 Exchange Place, New York City, Feb. 24.

Grand Rapids & Indiana, annual, Grand Rapids, Mich., March 4.

Missouri Pacific, annual, St. Louis, Mo., March 10

New York, Susquehanna & Western, annual, Taylor's Hotel, Jersey City, N. J., Feb. 26.

Norfolk & Virginia Beach, special, Norfolk, Va., March 2.

Northern Central, annual, Baltimore, Md., Feb. 26.

St. Louis, Iron Mountain & Southern, annual, St. Louis, Mo., March 10.

Toledo & Ohio Central, special, Toledo, O., Feb. 18, to consider a proposed increase of the capital stock.

Railroad and Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* meets at its rooms, in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of each month at 7:30 p. m. in the directors' room of the St. Paul Union station, except in the months of July and August.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1 122 Girard street, Philadelphia, on the first and third Saturday, of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Penn Building, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8:00 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8:00 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7.30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

American Society of Civil Engineers.

The following circular is issued by Mr. Collingwood, the Secretary:

The Secretary desires to present to the members the duty they owe to the society, of giving to it the advantage of their professional experiences by properly prepared papers. It is believed that nearly every member has had charge of some work, of which a description of its especial features, of the methods pursued in carrying it out, and the difficulties overcome, and of its success or *failure* would be of interest to the profession. The value of a paper is not necessarily proportionate to its length; and short, well-written papers are always acceptable. It is especially desirable that all writers do not wait for the annual convention to present their papers. It often happens that a more thorough discussion can be obtained at some other time in the year, and as a rule there will be less delay in publication if the papers are distributed throughout the year. . . . Some of our best members give it as their experience that a positive advancement in their professional standing and practice has always followed the presentation of an important paper to the society.

Celebration of the One Hundredth Anniversary of the American Patent System.

We announced a few weeks ago the proposed celebration of the beginning of the second century of the American patent system, to be held in Washington. We have now received a preliminary programme of the celebration, in which inventors and manufacturers of patented inventions are expected to take part. It will be held at Washington April 8, 9 and 10. A part of the programme will be the organization of the National Association of Inventors and Manufacturers on the afternoon of April 7 and at such subsequent meetings as may be necessary. The public meetings will be presided over by the President of the United States, Secretary Noble, Professor Langley and Professor Bell. Addresses will be delivered by many eminent men, among them Edward Atkinson, Dr. Billings, Justice Blatchford, Octave Chanute and Carroll D. Wright.

Civil Engineers' Society of St. Paul.

A regular meeting of the society was held in the Hotel Ryan at 8:30 p. m., immediately following the entertainment of the Minneapolis C. E. Society at dinner. There were present 18 members of the Minneapolis Society and 15 of the St. Paul Society. President Mason read an address of welcome to the visitors.

Applications for membership from Charles F. Hollingsworth and John B. Hawley were presented.

The President named Messrs. Rundlett, C. W. Johnson and Loweth as Examining Board for the ensuing year.

Mr. Morris' nomination of Messrs. A. Johnson, Rundlett and Powell as a committee to draw a memorial of Mr. J. Lathrop Gillespie was approved, and the secretary was directed to accept the gift of 28 volumes presented to the society by Bishop Geo. D. Gillespie, executor.

Mr. Van Duzer, of the Minneapolis Society, then read a paper on "Sewer Construction in Minneapolis." He illustrated the general plan of the system; recited its history and dwelt upon interesting details of construction. Minneapolis now has 80 miles of sewers, 20 of which were built in the last year, and wholly by day labor. Ninety-seven per cent. of the total mileage is the work of the last decade.

Mr. Münster's paper of last month, on a short method to results obtained by Gordon's formula, was then quite generally discussed. Several members, having tested the diagram based on his simplified formula, found the results practically correct, and indorsed the method without reservation.

Immediately previous to adjournment announcement was made that the second of the four proposed joint meetings of the two societies would be held in Minneapolis probably on the first Thursday in March.

Engineers' Club of Philadelphia.

A regular meeting was held Jan. 17, President Lewis in the chair, and 19 members present.

The Secretary presented, for Mr. George R. Henderson, an illustrated paper upon "Locomotive Driving Springs." The author said that he had occasion some years ago to examine quite thoroughly the laws governing the deflection of locomotive springs, and he found the formula usually given in books to be incorrect, because the shape of the spring is not given due consideration. He constructed a new formula, which he has proved by actual tests in a number of cases.

Mr. Carl Hering read a paper on a portable photometer for measuring street lights. He described the portable photometer devised by him, which had given very satisfactory results. The method adopted differed from the usual one in that the standard of light and the unknown light were both on the same side of the screen, and were balanced by an auxiliary portable light in the photometer at a fixed distance from the screen. The photometer is first calibrated by balancing this auxiliary light against the standard; this is done indoors. The photometer is then ready for use out of doors, the unknown light being balanced against the auxiliary by moving the whole photometer to or from the light. The adjustments are made so as to reduce the calculations to the simplest possible. The photometer consists of a light wooden tube open at both ends and containing the screen and auxiliary light, together with the switch and tape for measuring the distance. The auxiliary light was a small electric light supplied by a portable accumulator carried by the operator. This photometer could also be used to measure illumination in general, such as daylight, sunlight, moonlight, or the illumination on a table, desk, etc., for which measurements a stationary photometer cannot be used.

PERSONAL.

—Mr. J. N. McCullough, First Vice-President of the Pennsylvania lines west of Pittsburgh, died in Allegheny City, Pa., Feb. 8. Mr. McCullough was born at Yellow Creek, Ohio, Sept. 5, 1821, of Scotch parentage. He was engaged in river trading for some years, and later in the wholesale grocery business and as a banker. He had acquired a fortune when he became interested in railroading in 1858, being at that time elected President of the Cleveland & Pittsburgh. The road became a paying property in five years under his administration. In 1863 Mr. McCullough was appointed General Superintendent of the Pittsburgh, Fort Wayne & Chicago, and soon developed a large traffic. When, in 1871, the Fort Wayne was leased to the Pennsylvania, Mr. McCullough was promoted to the position of General Manager. Several years after this the Pennsylvania Company was organized, and he was elected First Vice-President and Executive Officer of this company, and the Pittsburgh, Cincinnati & St. Louis, and all the other Pennsylvania lines west of Pittsburgh. These offices he retained until his death. His services in perfecting the combination which these roads formed were of incalculable value. For over 30 years Mr. McCullough has been one of the foremost railroad managers, and his great ability has been appreciated by all acquainted with his work. Mr. McCullough was a large investor in railroad properties and mortgages on real estate. His fortune is estimated at several millions.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fé.—E. H. Davis has been appointed Assistant General Freight Agent at Topeka, Kan., to succeed A. P. Tanner. R. E. Torrington has been appointed to succeed Mr. Davis as District Freight Agent at Wichita, Kan.

Danville & Western.—The following officers have been elected: President, A. B. Andrews, of the Western & North Carolina road; Secretary and Treasurer, W. H. Marbury, of the Virginia Midland road; Directors, John H. Inman, P. M. Logan, Samuel Thomas, W. H. Payne, J. Willcox Brown, E. L. Daingerfield, C. G. Holland, J. S. B. Thompson.

Denver Apex & Western.—The incorporators are I. B. Porter, John C. Teller, William G. Smith, W. C. Miller and W. L. Durbin, of Denver, Col. The officers are I. B. Porter, President; W. C. Miller, Vice-President; W. G. Smith, Secretary and Treasurer.

Kansas City, Memphis & Birmingham.—The annual meeting of the stockholders at Memphis, Tenn., last week resulted in the election of the following directors: George H. Nettleton, Charles Merriam, Abbott Lawrence, H. H. Hunnewill, T. Jefferson Coolidge, E. V. R. Thayer, Nathaniel Thayer, Francis Bartlett, Alex. Cochrane.

Kentucky Central.—J. H. Ellis has been elected Secretary, vice Lewis Hood, resigned; and William W. Thompson, Treasurer, vice F. H. Davis, resigned. The road is now operated as a division of the Louisville & Nashville.

Macon Construction Co.—The following directors have been elected by the stockholders: W. B. Sparks, W. H. Virgin, Robert Ober, V. H. Rothschild, A. Backer, E. B. Waters, M. Nussbaum, H. J. Lamer, Sr.; H. J. Lamer, Jr.; George B. Jewett, Dr. John Ingalls, W. W. Collins and R. F. Lawton. The only change in the board was the election of H. J. Lamar, Sr., in place of Virgil Powers. The directors elected the following officers: Willis B. Sparks, President; H. J. J. Lamar, Vice-President; Henry L. Jewett, Secretary and Treasurer; H. M. Powers, Assistant Secretary and Assistant Treasurer, and Jefferson Lane, General Manager. The only change made was in the office of Vice-President, to which H. J. Lamar, Jr., declined re-election, H. J. Lamar, Sr., being elected in his place.

Massillon & Cleveland.—At the annual meeting held in Massillon, O., Feb. 3, the following directors were elected: Louis H. Meyer, Charles W. Cass, New York City; J. N. McCullough, John J. Haley and William F. Robb, Pittsburgh; John Sherman, Mansfield, and P. G. Albright, Massillon, O. Louis H. Meyer was elected President, and John J. Haley, Secretary and Treasurer.

Missouri, Little Rock & Pacific.—The incorporators are: B. E. Orr, New York City; H. S. Schwanecke, Little Rock; J. M. Rose, Little Rock; D. C. Rugg, Hot Springs, and H. C. Orr, Kansas City. The principal office is in New York City.

Muscatine, Rock Island & Peoria.—The incorporators of this Illinois road are: Andrew Henry, Peoria; William Wilmerton and F. H. Caldwell, Preëmption; S. J. Hodge and George Hodge, Wenona, Ill.

Oregon Improvement Co.—At a meeting of the directors of the company, held in Portland, Or., Prosper W. Smith tendered his resignation as Assistant Secretary and Treasurer, and the following new officers were elected: Meade E. Stone, Assistant Secretary, and Charles H. Tedcastle, Treasurer, both of New York.

Pennsylvania.—F. P. Abercrombie has been appointed Assistant Engineer of the Western division of the Philadelphia & Erie, and of the Susquehanna division of the Northern Central, vice Frank F. Robb, transferred to Harrisburg. H. B. Lincoln has been appointed Assistant Engineer, Sunbury division Philadelphia & Erie, and of the Shamokin division of the Northern Central, to succeed Mr. Abercrombie.

Philadelphia & Erie.—The following managers were elected at the annual meeting held in Philadelphia, Feb. 9: W. H. Wilson, J. N. Dubarry, Wistar Morris, S. G. Thompson, N. P. Shortridge, Henry D. Welsh, W. Welsh, W. J. Howard, W. L. Elkins, A. R. Little, J. Bayard Henry.

Pittsburg & Moon River.—The incorporators are: N. F. Sanford, Mansfield, Allegheny Co., Pa., President; Henry Gerdin, Jr., Pittsburgh, Pa.; J. H. Sanford, Alexander Patterson, Wilfred Stewart, William Wilcox, James Henderson, all of Mansfield.

Rome, Watertown & Ogdensburg.—H. A. Hodge has been appointed General Freight Agent in charge of local traffic, with office at Oswego, N. Y. Correspondence relative to through traffic, also coal, coke, ore and oil traffic, should be addressed to L. A. Emerson, General Traffic Manager, 96 Broadway, New York City.

St. Louis & Southwestern.—E. H. Osborne has been appointed Master Car Builder of the Pine Bluff (Ark.), shops.

Silver Lake.—The following directors have been elected by the road: Arthur G. Yates, George E. Merchant, Earl B. Putman, R. T. Tuttle, M. H. Olin, H. H. Warner, C. H. Blakeslee, F. W. Yates, H. N. Page, W. L. Kilpman, C. C. Hicks, Harry Yates and C. W. G. Noble.

Southern Pacific.—The following appointments have been made: James Beaumont, appointed Live Stock Agent of the Victoria division of the Gulf, Western Texas & Pacific, with headquarters in Victoria, Tex., vice R. H. Berry, resigned; M. C. Whalen, appointed Road Master of the Gulf, Western Texas & Pacific, in place of Mr. Beaumont; Frank Godin, appointed Road Master of the New York, Texas & Mexican, vice M. C. Whalen, transferred.

RAILROAD CONSTRUCTION.
Incorporations, Surveys, Etc.

Akron & Chicago Junction.—Little progress is being made at present on this extension of the Baltimore & Ohio, as only about 200 men are employed. The track has been laid for 30 miles west of Akron, O., and 60 miles have been graded. As soon as the ground becomes less hard the contractors will resume tracklaying and finish the work in a few weeks. The principal bridge work on the line is the erection of four 80-ft. spans and two 100-ft. spans. The road extends in a westerly direction from Akron to Chicago Junction, O., 69 miles and passes through the following towns: Akron, New Portage, Clinton and Warwick, Summit County; Easton, Rittman and Sterling, Wayne County; Creston, Lodi and Homer, Medina County; Sullivan, Troy and Ruggles, Ashland County; Greenwich and Chicago Junction, Huron County.

Aroostook & Penobscot.—A bill has been introduced in the Maine legislature to incorporate this company to build railroads in Aroostook and Penobscot counties, from Mattawamkeag easterly through Sherman, Patten, and Houlton, northerly to Presque Isle, to Van Buren or Fort Kent on the St. John River. The distance is about 150 miles. Several branches are also enumerated among others one to a point on the Bangor & Piscataquis road. Albert A. Burleigh is an incorporator.

Bangor & Aroostook.—Articles of association have been filed with the Railroad Commissioners of Maine for the incorporation of this company, which propose to build a road from the Bangor & Piscataquis at Brownville to Presque Isle, and from Dyer Brook Plantation to Ashland. The capital stock is $1,500,000.

Chicago, Burlington & Quincy.—Specifications for two bridges over the Missouri and Mississippi rivers in the vicinity of Alton, Ill., and for a new road, about 16 miles, to be built as a cut-off, are said to have been submitted to several contractors, including the Fruin-Bambrick Co., of St. Louis.

Chicago, Rock Island & Pacific.—Local trains were this week put on the division between Lincoln and South Omaha, Neb., which cannot be used for through trains until a settlement is reached in the Omaha bridge controversy with the Union Pacific.

Chicago & West Michigan.—It is reported that work will probably be begun on the extension from Traverse City, northwest, to Charlevoix or Petoskey, Mich., in the spring. Surveys were made for this road last year, and since then it has been said that the right of the Detroit, Charlevoix & Escanaba had been purchased. That road has done very little work, however; a few miles near Charlevoix has been partially graded. The line is about 70 miles long.

Denver Apex & Western.—This company was chartered in Colorado last week to build a road from the Union station in Denver west to Lookout Mountain and passing through Arapahoe, Jefferson and Clear Creek counties. The company is a reorganization of the one incorporated a year ago to build to Lookout Mountain Resort, and the surveys made then will be used by the new company, and the title to the right of way acquired will be transferred also. The capital stock is $500,000.

Duluth & Winnipeg.—The contractors state that they will soon have their forces grading the extension of the line from Cloquet easterly to Duluth, Minn. Donald Grant & Co. have let all the sub-contracts, and the grading will be completed, ready for tracklaying in May. The rails will be laid in June.

Fort Payne & Eastern.—A new survey has been ordered for the eastern extension of this Alabama road, and the engineers will probably begin to run the lines in two weeks. The survey is to be made from Fort Payne, Ala., to Rome and Gainesville and thence toward Savannah.

Fort Wayne, Terre Haute & Southwestern.—The company has a large force of men at work between Bridgeton and Mansfield, in Park County, Ind. The grade is completed to within two miles of Bridgeton, while most of the piling and substructure for the bridge across the Raccoon River is completed. About $20,000 has been paid landowners for right of way. Only a temporary restraining order was granted the Indiana Midland in its suit against this company to prevent its encroachment on its old roadbed. In a similar suit in Clay County the injunction was dissolved. The case is set for trial in the Parke Circuit Court this week.

Jacksonville Mining & Manufacturing Co.—The road to be built by this company at Tredegar (Jacksonville), Ala., has been referred to recently. The route is from the new steel plant of the Tredegar Steel Co., north, from the southern limit of the town of Tredegar and near the line of the East Tennessee, Virginia & Georgia main line, passing through the town to Iron Mountain, 9½ miles. The preliminary survey has been completed for the whole distance, and the location made for one-half. The contract for the first section of 4¾ miles has been let, and the contract for the balance will probably be let next week. The work will be commenced as soon as weather is settled, in a few weeks. Three-fourths of a mile of track from stone quarries west of

Tredegar to the steel plant is already laid. There is a fairly easy grade through the town to the mines the maximum is 1¼ per cent., except on about one mile, where it is 1½ per cent. A few unimportant trestles will be built.

Laney & Piedmont.—The end of track on this road, which is being built by the Piedmont Land Co., is about ten miles from Piedmont, Ala. The road is being extended to that point from Laney's, on the Louisville & Nashville. The distance is about 20 miles, and connection will be made at Piedmont with the East Tennessee, Virginia & Georgia.

Kansas City Terminal & Bridge Co.—The company has filed a mortgage to the Central Trust Co. of New York for $1,500,000. The securities for the loan are the franchises, bridges, and roadbeds of the Winner Belt Line in Kansas. The money is to be used for construction purposes on the Belt Line, which, when completed, will encircle both Kansas City, Mo., and Kansas City, Kas.

Lake Shore & Michigan Southern.—The Sandusky division is now a double track road from Toledo to Elyria, O., 78 miles, with the exception of a distance of 11 miles. The company is now preparing to start work on this incompleted section, and the second track will be laid in a few months.

Lehigh Valley.—The extensions of this road to Newark, N. J., will be opened for traffic in a few days. The lines are the South Plainfield & Roselle and Newark & Roselle, extending from the Lehigh Valley line at South Plainfield through Roselle to Newark, a distance of 21 miles. Until the Jersey City, Newark & Western is built the company will continue to use the tracks of the Pennsylvania to Jersey City.

Little Falls & Dolgeville.—The company has been incorporated in New York to build a road from Little Falls to Dolgeville, a distance of about 12 miles. It is to form a junction with the New York Central at a point about a mile east of the passenger station at Little Falls. By means of a "switchback" the road will ascend the rock bluffs, and extend easterly along the tableland, passing through Manheim Centre and Inghams Mills, to Dolgeville. Ultimately the road will be extended to Salisbury Centre and Deveroux and to Pisaco Lake, 32 miles. Near Salisbury there is located valuable magnetic iron ore land, which will be worked when this road is completed. It is expected that it will be in operation by July 1.

Louisville & Nashville.—McTighe & Co. will soon resume work on the nine miles of the Clarksville Mineral branch, which had not been graded when the contractors abandoned work on account of the winter weather. The track has been laid on over 10 miles, and 15 miles more are well advanced.

Memphis, Little Rock & Pacific.—Articles of incor poration were filed by this company in Arkansas last week. It proposes to build a road from Argenta, on the opposite side of the Arkansas River from Little Rock, thence to a point on the state line dividing Arkansas and the Indian Territory, and southeasterly through the counties of Pulaski, Saline, Garland, Hot Springs, Montgomery, Polk, Sevier and Little River, 150 miles in length. This is apparently simply a third formal reorganization of a road which has never done more than grade a few miles near Little Rock.

Mexican Southern.—The road has been recently opened for passenger traffic from Puebla to Tehuacan, Mex., a distance of 80 miles. The contractors, Read & Campbell, of the City of Mexico, have been running freight trains over the line for most of the distance for a considerable time and latterly over the entire division. The stations are as follows: Puebla, Amozac Santa Rosa, Tepeaca, Rosendo Marquez, Tecamachalco, Las Animas, Tlacotepec, Carnero and Tehuacan.

Muscatine, Rock Island & Peoria.—This company has been incorporated in Illinois with a capital stock of $2,000,000 to build a road from Muscatine via Rock Island to Peoria. The incorporators are Andrew Henry, ofPeoria; William Wilmerton and F. H. Caldwell, of Preëmption, and S. J. Hodge and George Hodge, of Winona, Ill.

New Roads.—The Egg Harbor Land Co. has been granted authority by the Town Council to build a road with either steam or electricity as a motive power from Egg Harbor, N. J., to Wollica River and Gloucester Lake, about 5 miles.

Niagara Shore Terminal.—Articles of incorporation of this company have been filed with the Secretary of State at Albany, N. Y. The company has a capital stock of $40,000 and will build a road from La Salle to Cayuga Island. It will connect with the New York, Lake Erie & Western.

Northern Pacific.—Matthews & Krech, who have the contract for tracklaying and ballasting on the Tacoma, Olympia & Gray's Harbor line, have about 300 men ballasting the line and expect to turn it over to the operating department this month. Stations have been erected at Gray's Park, Murray, Maxwell, Woodlawn and Olympia. The ballasting is also in progress on the Centralia & Gray's Harbor line, and the contractors will be through with that work in a month. On this line stations are being erected at Centralia, Mound Prairie, Black River Junction, Oakville and Montesano. The grading is finished between Montesano and Ocosto, Wash., on the Pacific coast, and will soon begin between Black River Junction and Olympia on the eastern end of the line.

The track on the Spokane & Palouse branch has been laid from Pullman, Wash., to Kendrick, a few miles north of Lewiston, Idaho, which is to be the south terminus of the branch for some time. The extension is 70 miles long, of which 23 were laid last year.

Omaha, Kansas Central & Galveston.—The preliminary survey has been in progress through Kansas for some months and is expected to reach Oklahoma City this week. The General Manager, C. M. Rawlings, and Chief Engineer, Edwin Reemer, have accompanied the engineers' party since it started out from Lyons, Kan., and they are said to have secured much of the right of way.

Pittsburg & Moon River.—This company has been incorporated in Pennsylvania to build a road six miles long from Groveton station on the Pittsburgh & Lake Erie, in Allegheny Co., Pa., to the village of Remington. The capital stock is $100,000. N. F. Sanford, Mansfield, is president.

Port Reading.—Nolan & Bros., Reading, Pa., and A. J. McBean, 906 Opera House Building, Chicago, have been awarded the contract for building the independent line of the Philadelphia & Reading from Bound Brook, N. J., to New York harbor. The line is about 19 miles long and extends from a point on the Lehigh Valley tracks, west of Bound Brook, near the present terminus of the Reading tracks; thence easterly between Bound Brook and Woodbridge, passing north of Metuchen to Port Reading, on the Arthur Kill, opposite Staten Island and between Sewaren and Tufts Point. The locating surveys have been completed and work is about to be started. The maximum grades are 37 ft. per mile. There are 23 iron bridges on the line and the bridge work will aggregate 2,275 ft. in length altogether.

Red River & Southwestern.—Surveys are being made by this company from Henrietta west to Archer, Tex., a distance of 40 miles. The grading and bridging will be done by the towns which the road will connect. The track will be laid by the Gainesville, Henrietta & Western, and the road operated in connection with that line as a division of the Missouri, Kansas and Texas.

Richmond & Danville.—At a meeting of the directors of the Virginia Midland Branch, held in Washington recently, it was decided to double-track the line from Alexandria to Orange, Va., a distance of 79 miles. All the real estate necessary for the new track and sidings has been acquired. The Chesapeake & Ohio will, after April 1, run its own trains over the road to Orange C. H., and thence direct to its main line at Gordonsville. Work on the improvements will be begun in the spring.

San Jose & Southern.—Preliminary surveys have been made for part of the northern division. Lines have been run to the Pacheco and Vanoche passes, and as soon as it is decided which offers the most suitable route the surveys will be continued through Fresno County.

Savannah, Americus & Montgomery.—The work on the Montgomery extension is still in progress both east and west of Hurtsboro, Ala., and nearly 15 miles of track has been laid near that town. The road has been completed from Louvale west to the Chattahoochee River, where the bridge is still in course of erection. Very little of the substructure is uncompleted. West of Hurtsboro the grading has been about finished to within 10 miles of Union Springs and 38 miles east of Montgomery.

Southern Maryland.—This road has not been in operation since last September, when all the rolling stock was burned and destroyed. Since that time the New York Improvement Co. has repaired the roadbed between Brandywine and Mechanicsville, Md., and train service will be resumed in a few days. The road is about 20 miles long, and an extension is proposed from Mechanicsville, southeast, to Point Lookout, at Chesapeake Bay.

State Line & Eastern.—This company has been incorporated in Indiana with $2,500,000 capital stock. It is proposed to construct 145 miles of road through Lake, Porter, La Porte, St. Joseph, La Grange, and Steuben Counties with terminal points in Illinois and Ohio. The directors are George W. Lenn, W. I. Doty, Leroy Armstrong, Thomas M. Whitehead, and Walter I. Pratt of Chicago.

Western New York & Pennsylvania.—Surveyors are reported to be again in the field working on the proposed line from Oil City to Jackson Centre, Mercer County, Pa. The surveying party is in charge of A. P. Bovier, of Elmira, N. Y. The survey made last winter will be followed for some distance, viz., down the right bank of the Allegheny River to the mouth of the Big Sandy, and up the Big Sandy to Polk. The line then will run parallel to the Lake Shore & Michigan Southern until Raymilton is passed, whence it will extend to Jackson Centre.

West Virginia & Pittsburgh.—The balance of the line between Shaversville, W. Va., and the mouth of Williams River will be placed under contract Feb. 16. The length of this line is about 35 miles, and the contract for half of the work was let a few weeks ago. Shaversville is a few miles above Sutton, Braxton County, and from that point the line extends south along Laurel Creek, crossing it several times, to Williams River, reaching the timber lands owned by the company. It is expected to build this line the present year. The other extensions will be ready for operation shortly. The extension from Westone south to Sutton, a distance of 44 miles, is all graded, and track laid and ballasted as far as Burnsville, 26 miles. The extension from Buckhannon to Newlon, a distance of 26 miles, is just being completed, and will soon be ready for operation. The line from Newlon southeast to Florence, a distance of nine miles, is under contract, but no work has yet been done.

Woonsocket & Pascoag.—The first trains on this road were run last Friday between Woonsocket and Harrisville, R. I., 10 miles, connecting with the New York & New England. Passenger trains will be running regularly in a short time, the transfer to the New York & New England having been practically made.

GENERAL RAILROAD NEWS.

Central of New Jersey.—The report for the year ending Dec. 31 shows gross earnings of $14,126,563; operating expenses and taxes, $8,161,275; net earnings, $5,965,287. The income from investments and premium on securities sold increased these earnings to $7,125,333. From this were deducted interest on bonded and other debt ($2,798,148) and proportion of earnings due for rentals under leases ($1,819 815), a total of $4,617,963, leaving a surplus for the year over all operating expenses, taxes, extraordinary repairs and fixed charges of $2,507,370. Quarterly dividends were paid at the rate of six per cent. per annum, amounting to $1,117,092, leaving a balance credited to profit and loss account of $1,390,278. The gross earnings from traffic of all kinds exceeded by $246,812 those of the preceding year, and were the largest in the history of the company, notwithstanding a decrease of $640,388 in receipts from anthracite coal. The operating expenses increased $236,188, the charges to this account including new bridges and other constructions and rebuilt cars valued at $246,815. There was a decrease in interest and rental charges in 1890 compared with 1889 of $90,055.

Chicago, Kansas & Nebraska.—Referee Newman Erb has forwarded to the United States Court in Kansas his decision in controversy arising over the attempt of the Rock Island to foreclose the mortgage on the road. The Rock Island advanced the money to build the road and accepted bonds in return, secured by a mortgage on the road, afterwards taking possession of the road under a lease which provided that 30 per cent. of the gross earnings should be paid to the original stockholders. The interest on the mortgage bonds became due and was not paid and foreclosure proceedings were begun. The counties holding stock in the road to the amount of $3,000,000 objected to the foreclosure on the ground that the interest was not defaulted, as the Rock Island had not paid over 30 per cent. of the gross earnings, but instead had paid only a part of the agreed percentage. The Rock Island claimed that it had paid the whole amount, less the operating expenses. The referee finds that the interest was in default and that the trustees had a right to foreclose. If this is accepted by the court and a decree of foreclosure made the counties will lose the money which they advanced for the purpose of aiding in the construction of the road.

Atchison, Topeka & Santa Fe.—The gross earnings, operating expenses (exclusive of taxes and rentals) and net earnings of the road and auxiliary lines for the month of December were as follows:

	Gross earn.	Oper. expen.	Net earn.	Oper. mileage.
Roads owned and controlled	$2,792,382	$2,110,601	$681,781	6,527
Roads jointly owned, Atchison, one-half	140,062	156,591	def. 16,529	577
Total, Atchison system	$2,932,444	$2,267,192	$665,252	7,104
St. Louis & San Francisco:				
Roads owned and controlled	$583,032	$319,157	$263,874	1,329
Roads jointly owned with Atchison, 'Frisco's one-half	137,136	150,239	def. 13,103	526
Total, 'Frisco system	$720,168	$469,396	$250,771	1,85
Aggregate, both systems	$3,652,612	$2,736,588	$916.024	8,959

Comparative Statement, all lines.

	Gross earn.	Net earn.	Per mile.—Gr. earn.	Per mile.—Net earn.	Mileage.
Atchison System: December, 1890	$2,932,444	$665,253	$412.76	$93.64	7,104.56
Dec., 1889	2,688,785	1,019,439	378.08	147.57	7,111.66
Inc. or dec.	I. $243,659	D. $384,186	I. $34.68	D. $53.93	D. 7.10
'Frisco System: December, 1890	$720 168	$250 772	$388.14	$135.15	1,855.37
December, 1889	710,496	348,401	382.94	187.78	1,855.37
Inc. or dec.	I. $9,672	D. $97,629	I. $5.20	D. $52.63	.....
Aggregated general system: Dec., 1890	$3,652,612	$916,024	$407.66	$102.23	8,959.93
Dec., 1889	3,399,281	1,397,840	379.09	155.89	8,967.03
Inc. or dec.	I. $253,331	D. $481,816	I. $28.47	D. $53.66	D. 7.10

Danville & Western.—The stockholders have authorized the issue of $1,052,000 of new bonds, the principal and interest of which is guaranteed by the Richmond & Danville. A portion of this new issue will be apportioned to the holders of the old Danville & New River bonds. The road has now passed into control of the Richmond & Danville and is being operated in that interest.

Kentucky Union.—J. Kennedy Tod & Co. and the Central Trust Co., of New York applied this week in the United States Circuit Court at Louisville, Ky., for a Receiver for this company. The complainants allege that they advanced to the company the sum of $72,500 with interest from Jan. 1, 1891, and that the company agreed to deliver $140,000 mortgage bonds in return which it has failed to do.

Mobile & Girard.—The Secretary of the Interior has issued instructions to the Commissioner of the General Land Office, under the recent Railroad Land Grant Forfeiture Act, in the case of this company, holding that it is entitled only to a quantity of land equal to that owned by the line from Girard to Troy, being 84 miles in length. But he holds that the company cannot take any lands upon which there were bona-fide pre-emption or homestead claims on Jan. 1, 1890, or which have been sold by the United States.

Norfolk & Western.—The following is a preliminary annual statement of the company for 1890: Gross earnings, $7,561,915; operating expenses, including taxes, $4,838,610; net earnings, $2,723,305; other income, interest, dividends, etc., $233,919; total income, $2,957,224. Interest charges—On funded debt, $1,751,967; on car trust obligations, $62,310; total interest charges, $1,814,007; net income for the year 1890, $1,143,217, from which dividends were paid: April 24, 1½ per cent. on 220,000 shares of stock, $330,000; Oct. 23, 1½ per cent. on 270,000 shares of stock, $405,000; total, $735,000. Of the remainder, $408,217, there was used for the purchase of bonds under the sinking fund clause of the equipment mortgage, $88,606; and the rest, $319,610, was added to the surplus income account, which, at the close of the year, amounted to $1,455,262. The above figures include the Scioto Valley division from Feb. 1 and the Maryland & Washington (Shenandoah Valley) division from Oct. 1. As compared with the previous year, including these divisions for corresponding periods, the gross earnings increased $1,086,057, or 17 per cent. The operating expenses, including taxes, increased $594,596, or 14 per cent.; and the net earnings increased $491,461, or 22 per cent.

Philadelphia & Erie.—The annual report for the year ending Dec. 31 shows the following: Gross earnings, $5,113,787, an increase of $424,650 compared with the year 1889; operating expenses, $3,389,920, an increase of $461,175, and net earnings, $1,742,115, a decrease of $36,457. The net income for the year from all sources was $322,355, while the amount credited to profit and loss for the year was $241,455. The whole number of passengers carried in 1890 was 1,432,946, an increase of 198,002, and the total tonnage of freight carried during the year was 10,557,438, an increase of 1,218,419. The report states that: In accordance with the resolution adopted at the last annual meeting, a revision has been made in the accounts of the company, and the amount heretofore standing to the debit of profit and loss has been charged to cost of construction.

Shepaug, Litchfield & Northern.—The following information is given in the annual report of the railroad commissioners of Connecticut: A controlling interest in the stock of this company, which had always been held by local parties, was in the spring of 1889 purchased by a New York syndicate. An agreement was subsequently made between them, the Mercantile Trust Co., of New York, and a committee of three named in the agreement, by which the Trust Co. was to receive this stock and any other which might be deposited with it, and, holding the same, issue to the

depositors of the stock trust certificates to an equal amount, to be negotiable in the same manner as the stock certificates, which trust certificates were to be surrendered and exchanged for the stock on the termination of the agreement, which was to continue in force for five years unless sooner terminated by consent of the holders of all the trust certificates, the trust company, in the meantime, to vote upon the stock held by it, at all meetings of the railroad company as the committee should direct. During the early part of last summer the managers of the Housatonic road became, by purchase, the holders of nearly 7,000 of the trust certificates and over 3,000 shares of the stock of the company, which last had not been taken by the prior syndicate. In the meantime the railroad company had executed a mortgage to secure an issue of $300,000 of first mortgage bonds, which were signed and registered, but not put upon the market, and on Aug. 21, after the purchase by the Housatonic parties, a meeting of directors, the legality of which is in question, voted to turn over the bonds to parties in the interest of the Croton Valley road for the construction of a connection between Shepaug, Conn., and the Hudson River. Suits and counter suits have been brought, both in Connecticut and in New York, by the parties in interest for various purposes, among others by a part of the original syndicate to recover back the trust certificates, and by the Housatonic parties to set aside the agreement mentioned, and to restrain the issue of the mortgage bonds, and annul the alleged agreement in regard to them. The immediate financial result has been the depletion of the treasury of the company, and the application for a receiver, which, however, has been denied. In the meantime, the annual meeting of the company which should have been held Nov. 12 has, by order of the court, been adjourned, pending decision of suits in Connecticut.

The suit brought in the Superior Court at Bridgeport, Conn., was decided this week in favor of W. H. Starbuck and the Housatonic, against G. D. Chapman and the Croton Valley. The temporary injuction secured to prevent the Mercantile Trust Co. issuing a new series of bonds amounting to $300,000, as proposed, for the extension to the New York state line, was made permanent.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Feb. 11, 1891.

The outcome of the cuts in passenger rates between St. Louis and Chicago, by the Jacksonville Southeastern, noted last week, was a demand by the other lines to be allowed to meet the rates of the Southeastearn line. Chairman Finley of the Western Passenger Association on Feb. 6 issued a notice to the Southeastern, to which under his general authority he attached the signatures of the general passenger agents of the Atchison, Chicago & Alton, Illinois Central and Wabash Companies, that "all tickets or other evidences of transportation" of the issue of that company sold subsequent to Feb. 18 will not be honored by the subscribers to the notice. This notice was accompanied by a letter to the general passenger agent of the Southeastern reciting the history of the case, and closing with the statement that the association is forced to take such action for its protection, after having been unable to secure any assurances that the Southeastern would desist from further demoralization of the business of the association. General Passenger Agent Kent of the Southeastern is reported as saying that he will pay no attention to the order; that he only met the rates of other lines, and that he will see that his tickets are accepted by his connections.

The new rules for the issuance of drovers' tickets are to be effective March 1. The plan for a joint agency has been abandoned, and tickets will be handled through the representatives of the individual lines.

The regular monthly meeting of the Central Traffic Association is also being held this week, and there is lively discussion over the ever-recurring charges of manipulations in eastbound grain rates by the fast freight lines. That there is cutting going on is evident, but the trouble is there are so many colored gentlemen in the fence that there are very few outside to catch them. Chairman Blanchard may conclude to call the presidents together.

Several of the roads have petitioned the Illinois Rail road and Warehouse Commission, protesting against the adoption of the new live stock rates as too low, and particularly against the provision of the schedule fixing the rates for the transportation of stock cattle and feeders at 75 per cent. of the rates on fat cattle, insisting that the rates should be the same.

The Chicago & Alton and Mobile & Ohio have made a close traffic contract for the interchange of business east of the Mississippi River to points in the south and southeast. This is to compete with the Illinois Central for southern business.

Secretary Smith, of the American Association of General Passenger and Ticket Agents, has issued a call for a special meeting to be held in this city Feb. 17. It is understood that this meeting will take the place of the regular meeting called for March 17 at Monterey, Cal.

Dispatches from St. Paul to the effect that the Canada Atlantic would not advance westbound rates via the "Soo" to the $1.20 (1st class) basis recently agreed upon are without foundation.

The Secretary of the National Transportation Association (association of Boards of Trade and corresponding bodies) has called upon all members to forward memorials to the Interstate Commerce Commission favoring a uniform bill of lading and uniform classification.

An interesting question of association jurisdiction has been raised by the action of the Western Passenger Association, noted above, in shutting off the Jacksonville Southeastern from the association lines. The Jacksonville Southeastern is the southern connection of the Atchison's Chicago-St. Louis line, which was opened in December last. The Atchison is a member of the Western Passenger Association, while the Southeastern is not, and refuses to be bound by the rulings of the association. Tickets of the new line were found in the St. Louis scalpers' offices at low figures, and the association at once reduced the open rate from St. Louis to Chicago from $7.50 to $5.75. The Southeastern extended its mileage tickets over the whole line. These tickets are sold at 2 cents per mile, while the association roads maintain a 2½ cent mileage rate. The other lines at once protested, claiming that as the Atchison was a party in the Chicago-St. Louis line it was responsible for the action of its connection. The Atchison people, however, disclaimed control over the northbound rate-making power, and insisted that they demanded and received their full proportion of the tariff rates, and that all rates made by them were strictly association rates. The Jacksonville Southeastern was then appealed to to withdraw its rates, but refused to do so on the ground that it was only meeting rates made by other lines. Further correspondence and conferences gave, to quote Chairman Finley, "no encouragement to hope for the inauguration of any policy looking to an impartial investigation and determination" of the question. The Alton in the meanwhile was demanding protection, and put in effect the reduced rate of 2 cents a mile on first class tickets from St. Louis to Jacksonville. Instead of taking the usual course and giving permission to make the cut rates and thus demoralizing rates throughout a considerable portion of the territory, Chairman Finley has availed himself of a provision of the agreement which provides that "each member of the association is required to see that its connections do not pursue any course which has the effect of contravening any of the rules or regulations of the association, and the chairman is directed that, in the event of any connecting line demorlizing the passenger revenue of lines in this association, he shall take such immediate steps in the name of the general passenger agents of all association lines interested as will protect them from this demoralization. He has accordingly notified the Jacksonville Southeastern in the names of the passenger agents of the Atchison, Chicago & Alton, Illinois Central and Wabash lines that these roads will refuse to honer its tickets after Feb. 18. Apparently the only courses now open to the Atchison in case the Jacksonville line persists in ignoring the requests of the association are 1, to compel its connection to restore and maintain rates at the association tariff; 2, to itself issue all northbound tickets at tariff rates; 3, repudiate the association agreement and continue the acceptance of the Jacksonville issue of tickets. The Jacksonville officers still maintain that they will not recede. What the Atchison will do is not known. The President and Vice-President of that road are expected to return to Chicago from the Pacific Coast about Feb. 15, and the date of Feb. 18 was fixed by Chairman Finley in order to give them an opportunity to adjust the matter after their return.

Traffic Notes.

Chairman Midgley, of the Southwestern division of the Western Freight Association, was yesterday elected chairman of all divisions, superseding Acting Chairman Osgood.

The Chicago, Burlington & Quincy has withdrawn its notice abolishing the reconsignment of grain at Kansas City, and hereafter will allow the privilege. The Burlington officials say they withdrew the privilege on account of the crooked expense bills, and resume it after being convinced that the majority of the grain men were not to blame.

Kansas City grain dealers have sent to the Interstate Commerce Commission a complaint against the railroads for discriminations in rates on shipments of Kansas grain to Kansas City as compared with Mississippi River points and beyond. Four railroads are made defendants—the Santa Fé, the Rock Island, the Missouri Pacific and the Burlington.

The Iowa Supreme Court has sustained the Joint-Rate Law, which was declared illegal by a lower court. The last decision refers to an appeal from the Railroad Commissioners' order, in which they not only say what the rate shall be on the traffic over two roads but also say what the division shall be by dividing it on a mileage basis, which is often unfair to the road that hauls it the shorter distance. The roads have thus far been doing business on the old basis and paid no attention to the order.

A New York paper says that a crisis has been precipitated in the relations of the trunk lines by the refusal of the Delaware, Lackawanna & Western to arbitrate the question of private stock cars. The live-stock situation has been drifting toward an acute stage for some time. In 1887 the trunk lines agreed to abandon the use of private cars, one exception being made in favor of a contract which the Lackawanna said it was bound by for several years. This contract is now before the Interstate Commerce Commission on complaints that the mileage paid by the Lackawanna to the car owner, the Lackawanna Live Stock Express, constitutes a discrimination against other shippers. The trunk line agreement to abolish the use of these private cars has been gradually growing weaker. The Lake Shore, claiming that it must meet the competition of the Grand Trunk and the Canadian Pacific, persisted in carrying private cars to Buffalo and finally it secured a connection over the Lehigh Valley. The latter road declares that it owns its live stock cars, but pays a royalty to the patentee. The other roads strongly suspect that the royalty is rebated to shippers. The Pennsylvania purchased 1,000 cars from S. W. Allerton, one of the big shippers over that road, and other shippers fear that the transaction favored him.

Southeastern Mississippi Association.

At a meeting of presidents and general managers in Nashville, Tenn., last week, the lines between the Ohio and Mississippi Rivers and Chattanooga, Birmingham, Montgomery and Pensacola (those outside the Southern Railway and Steamship Association) formulated an agreement which will be immediately circulated for signatures for the formation of an association to be known as the Southeastern Mississippi Association. The agreement is to take effect March 25 and exist one year. No member signing can withdraw under six months and only after 30 days' previous notice.

The Western Traffic Association.

The Commissioners of the Western Traffic Association completed the preliminary work of organization on Jan. 31. They have made a report to President Miller of the Advisory Board in which, after reciting the resolutions adopted at the New York meeting, referring to them the subject of the division of territory, they proceed to recommend the division of the territory of the association as follows:

THE WESTERN FREIGHT DIVISION

includes Minnesota, Iowa, Wisconsin, the Peninsula of Michigan, that part of the state of Illinois on and west of the line of the Illinois Central Railroad from Chicago via Effingham and the Vandalia road to St. Louis, that part of the state of Missouri on and north of the St. Louis & San Francisco Railroad (following its Vinita line west of Springfield), that part of the State of South Dakota east of the Missouri River, and that part of the state of North Dakota east of the meridian at which the Missouri River crosses its southern boundary line; also including the business of all points on the western bank of the Missouri River from Kansas City to the southern boundary of North Dakota interchanged with points in the territory above described and points east thereof; also including business interchanged between points on or east of the Mississippi River south of St. Louis, and any or all points above described. It is understood, however, that business interchanged between any two points on the Missouri River shall not be included in this division.

THE SOUTHWESTERN RAILWAY AND STEAMSHIP DIVISION

includes Texas, Arkansas, that part of the Indian Territory lying south of a line drawn through Fort Smith, Ark.; South Canadian, Purcell and Minco, I. T., and thence via the South Fork of the Canadian River to the western boundary of the Indian Territory; that part of the state of Louisiana west of the Mississippi River, and that part of the state of Missouri south of the line of the St. Louis & San Francisco Railroad. It being understood that business to or from the Republic of Mexico via Rio Grande crossings, also all stations on the line of the Southern Pacific road west of El Paso, to and including Benson, Arizona, shall be included in this division; provided, however, that business between Mississippi River points and points outside of the territory above described shall not be included in this division

THE TRANS-CONTINENTAL DIVISION

includes all that portion of the United States west of the following described line, viz.: Beginning on the northern boundary line of the United States at the meridian of Garrison, thence south to Garrison; thence southerly along the line of the Utah Northern Railway to Ogden (but not including Garrison, Ogden, or any station on the line of the Utah Northern Railway or its branches); from Ogden westerly along the line of the Central Pacific road, including all stations on the line of said road, to the eastern boundary of Nevada; thence along said eastern boundary line of Nevada to the Colorado River; thence along said Colorado River to the southern boundary line of the United States; provided, however, that all the stations on the line of the Southern Pacific road in Arizona west of and including Tucson shall also be included in the territory of the Trans-Continental Division.

THE TRANS-MISSOURI DIVISION

includes all territory east of the Trans-Continental Division, west of the Western Division, and north of the Southwestern Railway & Steamship Division, including business between points on the Missouri River, and business of all points on the eastern bank of the Missouri River from Kansas City to the southern boundary of North Dakota interchanged with points in the Trans-Missouri Division.

PASSENGER TRAFFIC.

The Board recommends that in view of the independent position of several of the members of the present Southwestern Railway & Steamship Association the passenger traffic of its territory heretofore uncontrolled by existing passenger associations be assigned to the Southwestern Railway & Steamship Division; provided that before the April meeting of the Advisory Board a passenger department shall be organized by the lines members thereof.

The Board further recommends that it having been represented to them that the railroads operating in the territory assigned to the Trans-Missouri Division are desirous that the conduct of their passenger traffic shall also be included in that division, and most of the roads referred to are at this time members of the Western Passenger Association, and as such are under certain prescribed obligations thereto, that when the railroads referred to arrange in due form to sever their connection with the Western Passenger Association, their passenger traffic carried within the territory of the Trans-Missouri Association shall be included in that division, and shall be subject to its control, and that thereupon the territory of the Western Passenger Division be made the same as that of the Western Freight Division.

The Board further recommends that the Passenger Departments of the Trans-Missouri and South-Western Railway & Steamship divisions be organized as nearly as practicable in conformity with the existing agreement and rules of the Western Passenger Association.

THE NEW TERRITORY.

By establishing the foregoing boundaries the Commissioners have assigned territory previously unassigned as follows: A portion of Illinois, northern Minnesota, eastern North and South Dakota, and the Peninsula of Michigan to the Western Freight Division; southern Missouri, Arkansas and the southerly part of Indian Territory to the Southwestern Railway & Steamship Association; territory between the former easterly boundary of the Trans-Continental Association and the Trans-Missouri Association has been assigned to the Trans-Continental Division.

The Commissioners recommend that the freight divisions be designated and known as the Lake, Gulf, Trans-Missouri and Trans-Continental divisions, respectively. Mr. J. W. Midgley is to be Commissioner of the Lake Division, Mr. J. N. Faithorn of the Gulf Division, Mr. James Smith of the Trans-Missouri Division, and Mr. E. P. Vining of the Trans-Continental Division. Mr. W. W. Finley remains in charge of the Passenger Division. Chairman Walker and Commissioners Midgley and Finley will have their headquarters at Chicago, Commissioners Faithorn and Vining at St. Louis, and Commissioner Smith at Kansas City.

Until the new association is fully organized and in working order, the various associations which are to be amalgamated will continue their operations as now constituted, subject to the action of the full Board of Commissioners of the Western Traffic Association upon subjects of common interest to its members, including appeals, application for relief, etc., as provided in the new agreement.

As to the control of rates upon traffic passing from or through the territory of one division into or through the territory of another division, the Commissioners call attention to the provisions of Article VIII. of the By-laws, which provides that all action of the Rate Committees shall be revised and approved in writing by the General Manager or highest traffic officers of the interested members before becoming operative, which is construed as requiring such approval by such officer of every line member of the division in which the action originates, and also if all other interested lines members of the Association.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending Saturday, Feb. 7, amounted to 75,467 tons, against 77,344 tons during the preceding week, a decrease of 1,877 tons, and, against 105,359 tons during the corresponding week of 1890, a decrease of 20,042 tons. The proportions carried by each road were:

	Wk. to Feb. 7.		Wk. to Jan. 31.	
	Tons.	P. C.	Tons.	P. C.
Michigan Central	10,490	13.9	10,310	13.4
Wabash	4,628	6.1	3,849	5.0
Lake Shore & Michigan South.	11,081	14.7	14,429	18.7
Pitts., Ft. Wayne & Chicago	7,706	10.3	8.161	10.6
Chicago; St. Louis & Pitts	8,242	10.9	10,202	13.4
Baltimore & Ohio	4,861	6.4	5,853	7.3
Chicago & Grand Trunk	10,332	13.7	12,194	15.8
New York, Chic. & St. Louis	10,241	13.6	8,827	11.4
Chicago & Erie	7,836	10.4	3,419	4.4
Total	75,467	100.0	77,344	100.0

Of the above shipments 6,743 tons were flour, 32,941 tons grain, 4,200 tons millstuffs, 7,143 tons cured meats, 4,697 tons lard, 7,170 tons dressed beef, 805 tons butter, 1,144 tons hides, 127 tons wool and 5,404 tons lumber. The three Vanderbilt lines together carried 42.2 per cent., while the two Pennsylvania lines carried but 21.2 per cent.